PROGRAM

PART1: Towards Sustainable Societies *6 November 2006*

8:00- 8:30	Opening Remarks *Masao Toyoda, RISS Executive Director, Osaka University* *Dong Thi Bich Thuy, Vice-rector, University of Natural Sciences, VNU-HCM* *Bui Cach Tuyen, Rector, Nong Lam University*
8:30- 9:00	Industrial Transformation Strategies towards Sustainable Development *Tohru Morioka, Osaka University*
9:00- 9:30	Environmental Management in Industrial Development: Resources Conservation and Material Recycling Strategy in Vietnam *Phung Thuy Phuong, University of Natural Sciences, VNU-HCM*
9:30-10:00	Integrated Water Resource Management Strategies towards Sustainable Development *Kenichi Nakagami, Ritsumeikan Asia Pacific University*
10:00-10:20	*Coffee Break*
10:20-10:50	From Wastes to Benefits towards Zero Industrial Emission in Ho Chi Minh City *Phan Minh Tan, Ho Chi Minh City Department of Science and Technology*
10:50-11:20	Plant-based Fuel Potential as a Renewable Energy Source *Akio Kobayashi, Osaka University*
11:20-11:50	Biomass-Asia Partnership *Shinya Yokoyama, The University of Tokyo*
11:50-12:20	Future Prospect of Biomass Utilization in Vietnam *Bui Xuan An, Nong Lam University*
12:20-13:40	*Lunch Break*
13:40-14:10	Vulnerability and Sustainability of Biomass Production in Tropical Wetland *Mitsuru Osaki, Hokkaido University*
14:10-14:40	Conservation of Biological Productivity Supporting Sustainable Biomass Utility *Takashi Machimura, Osaka University*
14:40-15:10	Toward Sustainable Rural Development: Combining Biodiversity Conservation with Poverty Alleviation - A Case Study in Phu My Village, Kien Giang Province, Vietnam *Tran Triet, University of Natural Sciences, VNU-HCM*
15:10-15:20	Closing Remarks *Kazuhiko Takeuchi, IR3S Deputy Executive Director, The University of Tokyo*
15:20-16:00	*Refreshment*

PART 2: Industry Transformation with Zero Emission Initiatives *7 November 2006*

8:00- 8:30	Opening Remarks *Hiroyuki Fujimura, Chairman of UNU/ZEF* *Nguyen Van Chien, Ho Chi Minh City Department of Natural Resources and Environment* *Osamu Shiozaki, Consul General, Consulate General of Japan in Ho Chi Minh City*
8:30- 9:30	Key Note Speech: Zero Emission and Sustainable Development *Motoyuki Suzuki, Special Programme Advisor, United Nations University*
9:30- 9:50	*Coffee Break*
9:50:10:40	Missions and Activities of UNU/ZEF *Hiroshi Sasaki, UNU/ZEF*
10:40-11:30	Construction Industry's "Green" Strategy *Masato Saitoh, Obayashi Corporation*
11:30-12:20	Zero-Emission Activities at Canon *Yasufumi Sato, Canon Inc.*
12:20-13:40	*Lunch Break*
13:40-14:30	Sustainable Society Creation Applying Renewable Energies *Masao Takebayashi, UNU/ZEF*
14:30-15:20	From Manufacturing to Ecofacturing: Cement Co-processing in Japan *Yutaka Yasuda, Taiheiyo Cement Corporation*
15:20-16:10	Biomass Applications for Zero Emission Achievement *Tsuneyuki Ueki, Ebara Corporation*
16:10-16:20	Closing Remarks *Tohru Morioka, Osaka University and UNU/ZEF*
16:20-17:00	*Consulting time (with refreshment)*

Industrial Transformation Strategies towards Sustainable Development

Tohru Morioka *

Prof. of Osaka Univ., Dept. of Sustainable Energy and Environmental Eng., Graduate School of Engineering

Director of RISS (Research Institute of Sustainable Science), Osaka University

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tmorioka@see.eng.osaka-u.ac.jp

The strategies to develop a "Loop-closing, ecologically sound, and innovative society" show some similarities with the IHDP-IT, so called as "Industrial Transformation" research frame. The IT research is defined as integrated actions towards an environmentally sound development for industrial systems, production process, corporation, industrial estate, city/region, and the global economy with eco-efficiency innovation and green product/service supply chain management to achieve life-cycle-based minimization of environmental burdens. These research initiatives have in common the search for a transition towards a sustainable society with emphasis in Asia. In this presentation

The author introduces the scientific efforts to achieve a vision of "Sustainable Asia" through the attempt to promote the loop-closing economy, 3R (reduce, reuse and recycle)programs, Eco-town and Eco Industrial Park (EIP) networking, product and service systems (PSS), urban-rural linkage and eco-infrastructure management in metropolitan area. These industrial metabolism issues are discussed within the research framework of the Research Institute for Sustainability Science (RISS), as well as the research framework of the Integrated Research System for Sustainability Science (IR3S) Flagship research project named as "loop-closing and ecologically symbiotic society in Asia."

Finally, the research proposal of urban metabolism management and biomass industry promotion in/around HCMC is shown in this presentation. Reviewing the socio-economic characteristics of industries, energy supply and consumption, and biomass production in agriculture, besides state of the basic environmental infrastructures in Vietnam, the author would like to emphasize that integrated framework should take a role of (1)linking agriculture and biomass processing industry with each other in terms of by-products, information, and split, and (2)demonstrating priority activities of technology development, economic policy, and institutional programs in international collaboration research.

The research on urban metabolism management or biomass industry promotion is expected to be executed under the partnership among multiple stakeholders of academia, corporations, government, citizens in Vietnam, Japan and other countries. The RISS workshop on the 22nd of Nov. 2006 at Osaka and the forthcoming research in HCMC and rural areas should produce the beneficial results including suggestions of solution.

Human, Society, Global Environment
Research Institute for Sustainability Science

大阪大学
サステイナビリティ・サイエンス研究機構
Osaka University Research Institute for Sustainability Science

Industrial Transformation Strategies toward Sustainable Development

Nov 6 2006, at HCM-City

Research Institute for Sustainability Science (RISS)

Prof. Tohru Morioka*1 and Flagship project member*2

*1Director, Design House of RISS, Osaka Univ.

***2 O.Saito, Y. Yamamoto, Y.Yamaguchi, H.Yabar, K.Hara, H.Zhang,and M.Uwasu**

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Outline of the presentation

1. Introduction to Research Institute for Sustainability Science (RISS), Osaka University
2. Concept of closed loop society for Asia and Flagship Project of IR3S
3. Sustainable & closed loop society in Ho Chi Minh City –Introductory story :Urban metabolism management and biomass industry promotion -

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Research Institute for Sustainability Science, Osaka Univ.

1. Introduction to Research Institute for Sustainability Science (RISS), Osaka University

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Contents of RISS introduction

1-1 What is Sustainability Science?

1-2 Our Mission

Eco-industrial Technology Development
& innovative socio-technical system

1-3 Industrial technology innovation

1-4 Can we achieve sustainable development with technology innovation only?

1-5 Back-casting approach in scenario design

1-6 How to boost cooperation

1-7 Sustainability education program

1-8 Building networks for sustainability research & education

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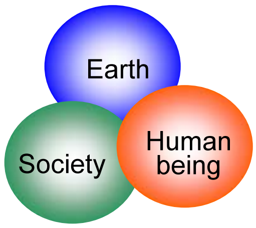
1-1 What is Sustainability Science?

【Sustainability Science】

It is the comprehensive study on the multiple and complex interactions of the earth-society-human system with the aim to achieve sustainable human welfare & societal development

「unsustainability syndrome」

Problems arising from the earth-society-human interactions



- Earth system; energy, resources, ecosystem, etc
- Social system： political-economic system, industrial structure, technology system
- Human system： lifestyle, ethics, values, etc

Triple bottom-line in human-society-earth system

- pressures on the environment such as pollution, resources depletion, climate change, etc constitute a threat to human existence. This study proposes the innovation of current patterns based on sustainable production and consumption as well as sustainable urban and industrial development.

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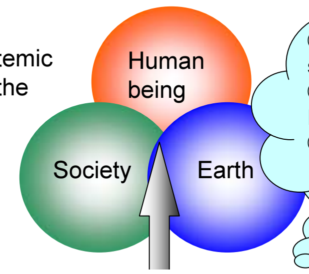
1-2 Developing Eco-industrial Technologies and innovative societal system to address sustainable development goals

Our Mission

①What is the task？

Understanding the systemic relationships between the three systems



①Research (science for sustainability)
②Education (minor course of SS In Post-graduate school)
③Practice(project implementation in region and world)

Capability to design future society scenarios and management strategies in innovation of technologies and industries

③Practices

②What to do？

Technologies-related soft (system, R&D) and *physical/engineering design* to improve sustainability

Market-based and legal framework to support to improve sustainability

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1-2 Eco-industrial Technology Development & innovative social-technical system

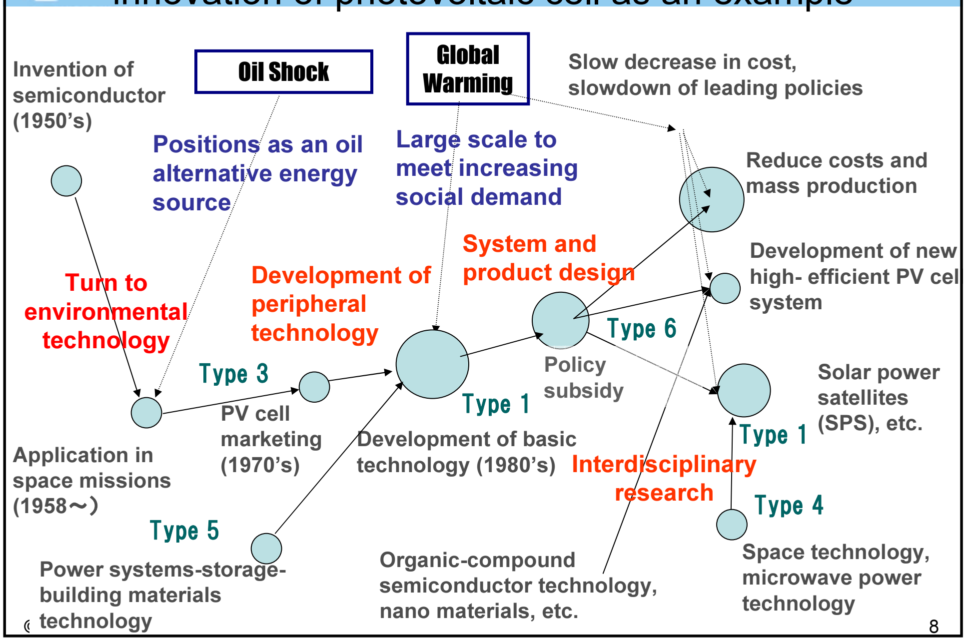
RISS aims at achieving a loop-closing (cycle) economy through:

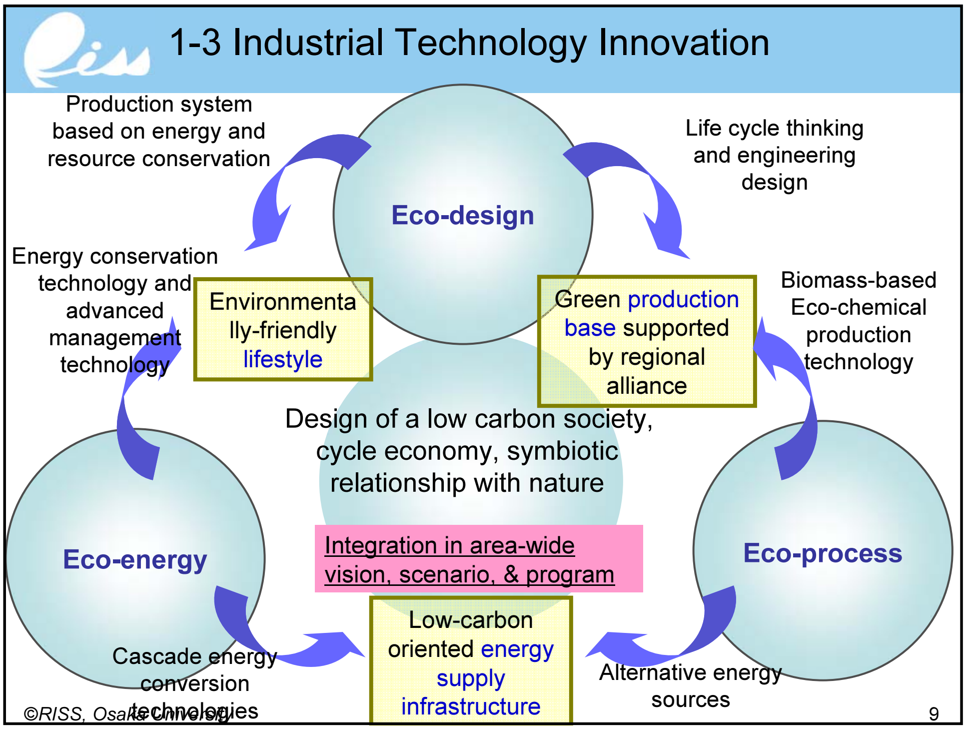
(1) ***designing visions and strategies to achieve a society that minimizes the environmental burden*** **by loop-closing in resources using;**

(2) **designing urban and regional systems that** ***prioritize the use of eco-technology and industrial ecology approaches*****;**

(3) ***integrating*** **low-impact and high-efficient production/infrastructure technologies** ***for urban and regional services***

1-2 Societal system & tech. development Interactions in innovation of photovoltaic cell as an example




1-3 Industrial Technology Innovation
Production system based on energy and resource conservation
Life cycle thinking and engineering design
Eco-design
Energy conservation technology and advanced management technology
Environmentally-friendly lifestyle
Green production base supported by regional alliance
Biomass-based Eco-chemical production technology
Design of a low carbon society, cycle economy, symbiotic relationship with nature
Eco-energy
Integration in area-wide vision, scenario, & program
Eco-process
Low-carbon oriented energy supply infrastructure
Cascade energy conversion technologies
Alternative energy sources
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1-4 Can we achieve sustainable development with technology innovation alone?
GREENING our Economy
Economy-finance-market
Economical orientation
Taxation, public investment
Subsidy, levy
Procurement & accounting
Corporate activity and national economy system
GREENING our Governance
Government/administration, corporate governance, community governance
Self- management & external evaluation
Contracts and agreements
Solidity and subsidies
Centralization and localizati
Three directives in fourth dimensions
Voluntary, communication, disclosure
Institutional orientation
Framework law and particular enforcement laws
Regulation law and induced law
Soft law and hard law
Laws, rules, norms
Living space and informat etwork
Freedom of choice and self responsibility
Communication and interface
Education (individual, organization) and culture
Culture, education, ethics
GREENING our Societal Rule
GREENING our Value & Culture
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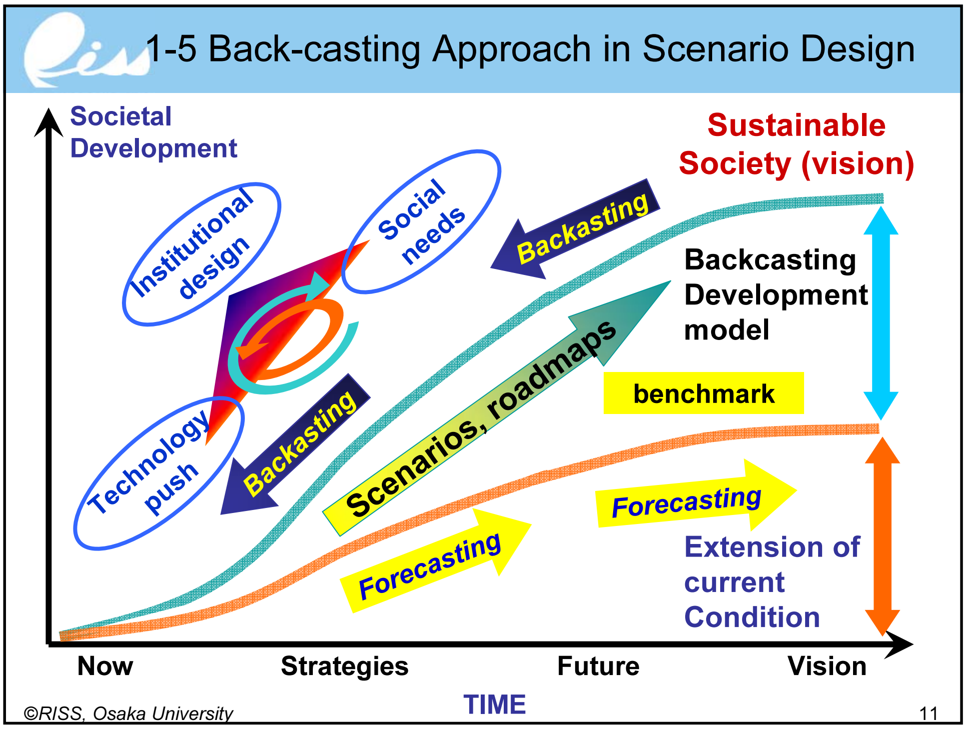

1-5 Back-casting Approach in Scenario Design
Societal Development
Sustainable Society (vision)
Institutional design
Social needs
Backasting
Backcasting Development model
Technology push
Backasting
Scenarios, roadmaps
benchmark
Forecasting
Forecasting
Extension of current Condition
Now
Strategies
Future
Vision
TIME
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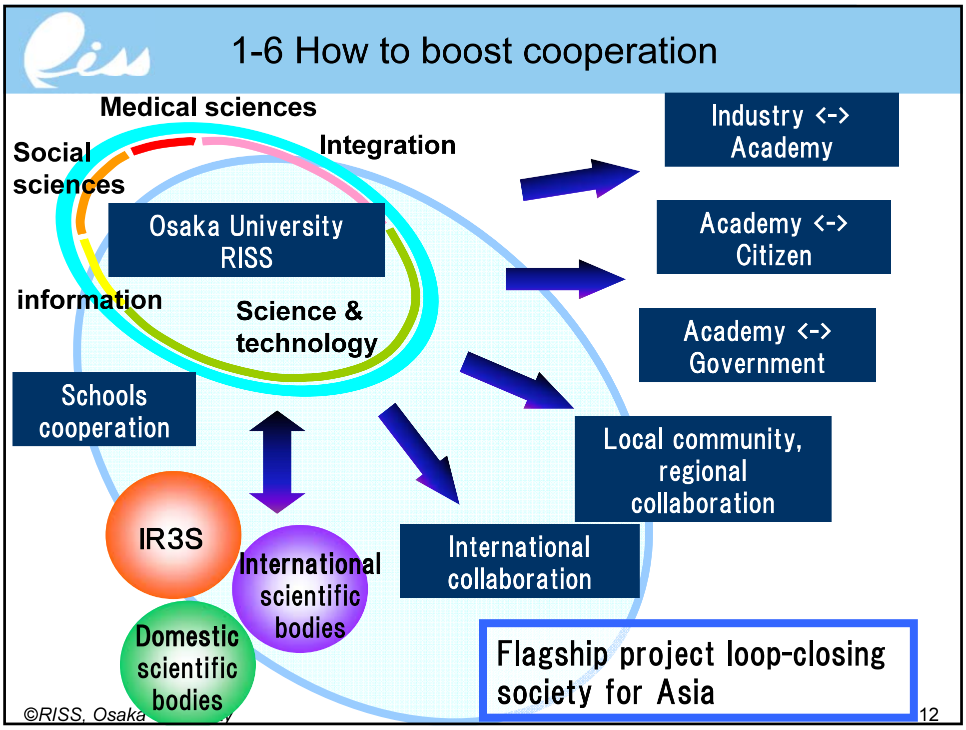

1-6 How to boost cooperation
Medical sciences
Social sciences
Integration
Osaka University RISS
information
Science & technology
Industry <-> Academy
Academy <-> Citizen
Academy <-> Government
Schools cooperation
Local community, regional collaboration
IR3S
International scientific bodies
International collaboration
Domestic scientific bodies
Flagship project loop-closing society for Asia
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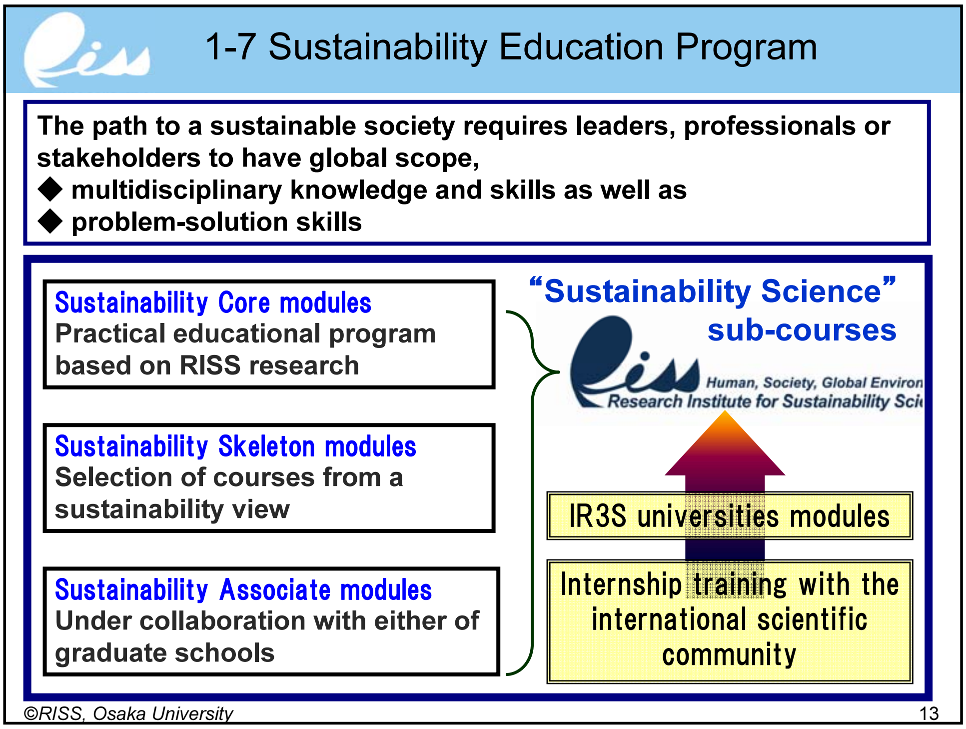
1-7 Sustainability Education Program
The path to a sustainable society requires leaders, professionals or stakeholders to have global scope,
◆ multidisciplinary knowledge and skills as well as
◆ problem-solution skills
Sustainability Core modules
Practical educational program based on RISS research
Sustainability Skeleton modules
Selection of courses from a sustainability view
Sustainability Associate modules
Under collaboration with either of graduate schools
"Sustainability Science" sub-courses
IR3S universities modules
Internship training with the international scientific community
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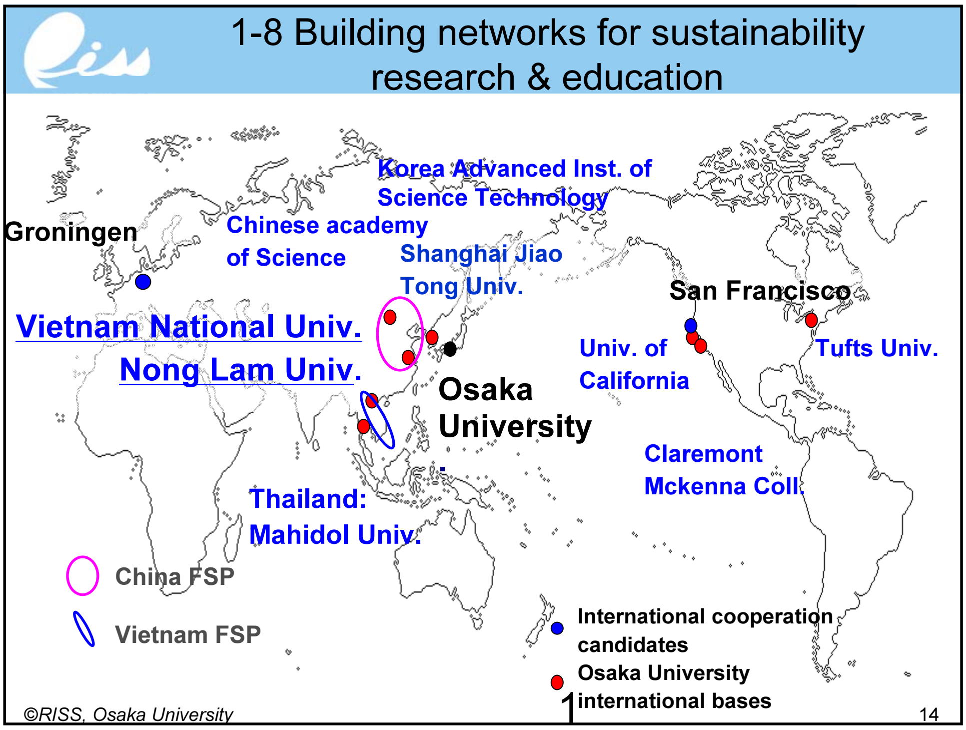
1-8 Building networks for sustainability research & education
Groningen
Korea Advanced Inst. of Science Technology
Chinese academy of Science
Shanghai Jiao Tong Univ.
Vietnam National Univ.
Nong Lam Univ.
Osaka University
San Francisco
Univ. of California
Tufts Univ.
Claremont Mckenna Coll.
Thailand: Mahidol Univ.
China FSP
Vietnam FSP
International cooperation candidates
Osaka University international bases
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2. Concept of closed-loop society for Asia and Flagship Project of IR3S

Industrial transformation is defined as integrated actions of the environmentally sound development of industrial systems of production process, corporation, industrial estate, city/region, and the global economy with eco-efficiency innovation and green product/service supply chain management to achieve life-cycle-based minimization of environmental burdens towards Sustainable Asia.

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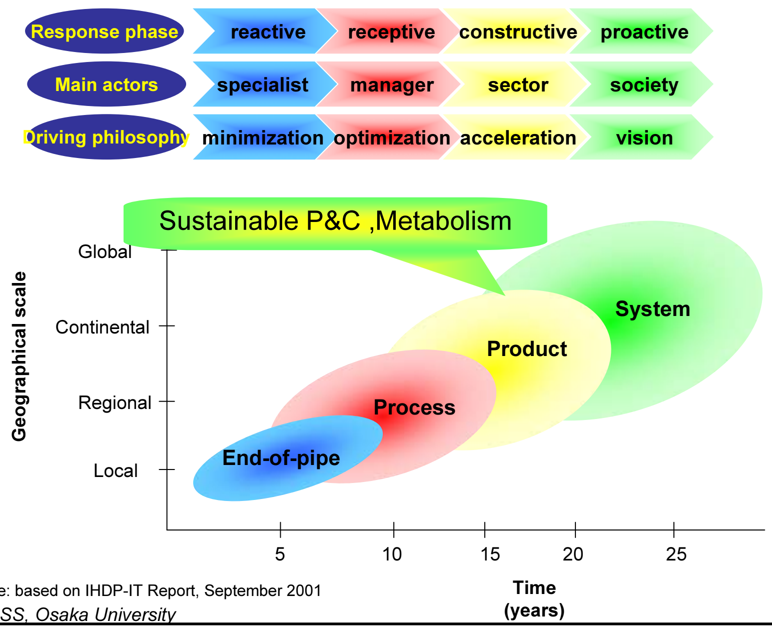
2-1Socio-economic Evolution towards Sustainable Development



Source: based on IHDP-IT Report, September 2001

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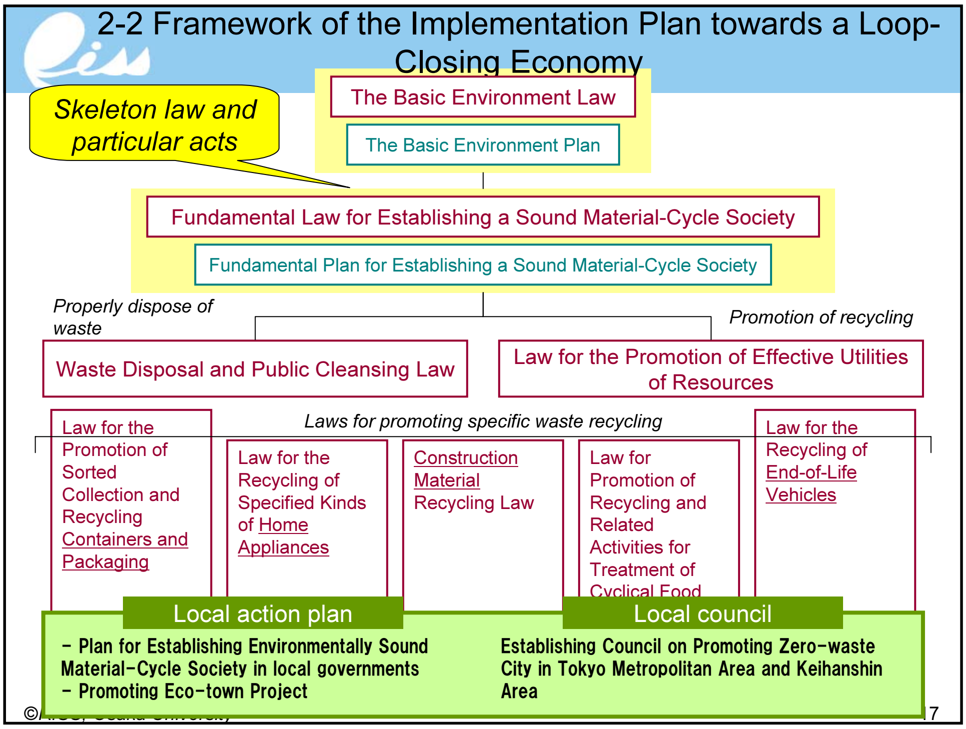
2-2 Framework of the Implementation Plan towards a Loop-Closing Economy
Skeleton law and particular acts
The Basic Environment Law
The Basic Environment Plan
Fundamental Law for Establishing a Sound Material-Cycle Society
Fundamental Plan for Establishing a Sound Material-Cycle Society
Properly dispose of waste
Promotion of recycling
Waste Disposal and Public Cleansing Law
Law for the Promotion of Effective Utilities of Resources
Laws for promoting specific waste recycling
Law for the Promotion of Sorted Collection and Recycling Containers and Packaging
Law for the Recycling of Specified Kinds of Home Appliances
Construction Material Recycling Law
Law for Promotion of Recycling and Related Activities for Treatment of Cyclical Food
Law for the Recycling of End-of-Life Vehicles
Local action plan
- Plan for Establishing Environmentally Sound Material-Cycle Society in local governments
- Promoting Eco-town Project
Local council
Establishing Council on Promoting Zero-waste City in Tokyo Metropolitan Area and Keihanshin Area
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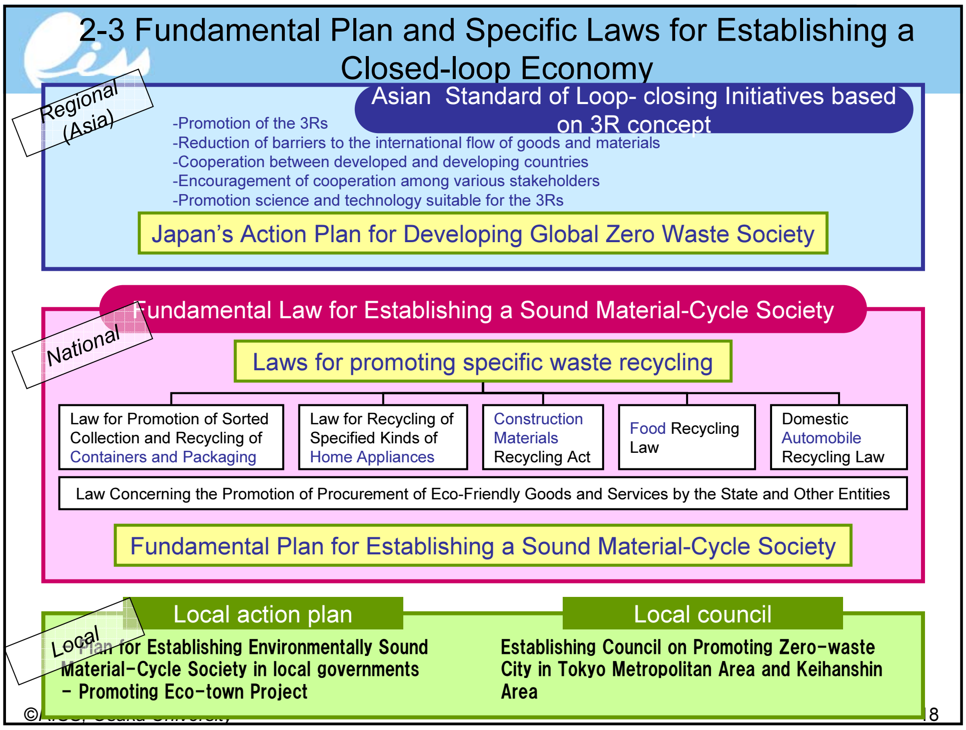
2-3 Fundamental Plan and Specific Laws for Establishing a Closed-loop Economy
Regional (Asia)
Asian Standard of Loop- closing Initiatives based on 3R concept
-Promotion of the 3Rs
-Reduction of barriers to the international flow of goods and materials
-Cooperation between developed and developing countries
-Encouragement of cooperation among various stakeholders
-Promotion science and technology suitable for the 3Rs
Japan's Action Plan for Developing Global Zero Waste Society
National
Fundamental Law for Establishing a Sound Material-Cycle Society
Laws for promoting specific waste recycling
Law for Promotion of Sorted Collection and Recycling of Containers and Packaging
Law for Recycling of Specified Kinds of Home Appliances
Construction Materials Recycling Act
Food Recycling Law
Domestic Automobile Recycling Law
Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities
Fundamental Plan for Establishing a Sound Material-Cycle Society
Local
Local action plan
- Plan for Establishing Environmentally Sound Material-Cycle Society in local governments
- Promoting Eco-town Project
Local council
Establishing Council on Promoting Zero-waste City in Tokyo Metropolitan Area and Keihanshin Area
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2-4. Japan's Action Plan for Developing Global Zero Waste Society Through 3R Initiative

- -Promotion of the 3Rs (higher priority to material input reduction and product reuse)
- -Reduction of barriers to the international flow of goods and materials
- -Cooperation between developed and developing countries
- -Encouragement of cooperation among various stakeholders
- -Promotion science and technology suitable for the 3Rs

Asian FTA-EPA

Japan's Action Plan for Global Promotion of Zero Waste International 3R Initiatives

Realization of zero-waste society in Japan and dissemination of the experience

✓Implementation of the fundamental Plan to establish a sound material-cycle society, integral and quantitative targets
✓Further strengthening of 3R actions: DfE, local plans, individual recycling laws, etc

Support for the zero-waste societies in developing nations

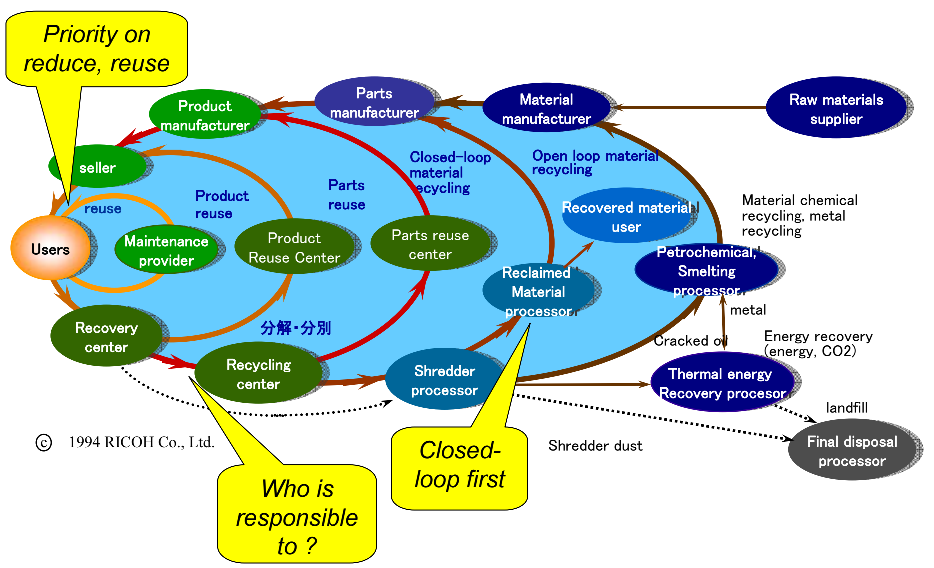
✓ Capacity building for establishing sound material-cycle society in developing countries. Ex. Eco-product fair organization , hubs creation via capacity building, support for recycling, etc

International cooperation to realize world-wide zero-waste societies

✓Implementation policy measures towards developing zero-waste policies in cooperation with various countries and institutions. Ex. Official meetings for 3R initiatives, strengthening linkages with international organizations, formulation of East-Asia sustainable society vision, etc
✓Enhancement of knowledge base and technology base for promotion of zero-waste in Asia
✓Zero-waste society promotion through providing information and developing networks

©RISS, Osaka University Source: Japanese Ministry of Environment Homepage: http://www.env.go.jp/recycle/3r/en/approach/01.pdf 19

2-5 Sustainable Product Chain Management



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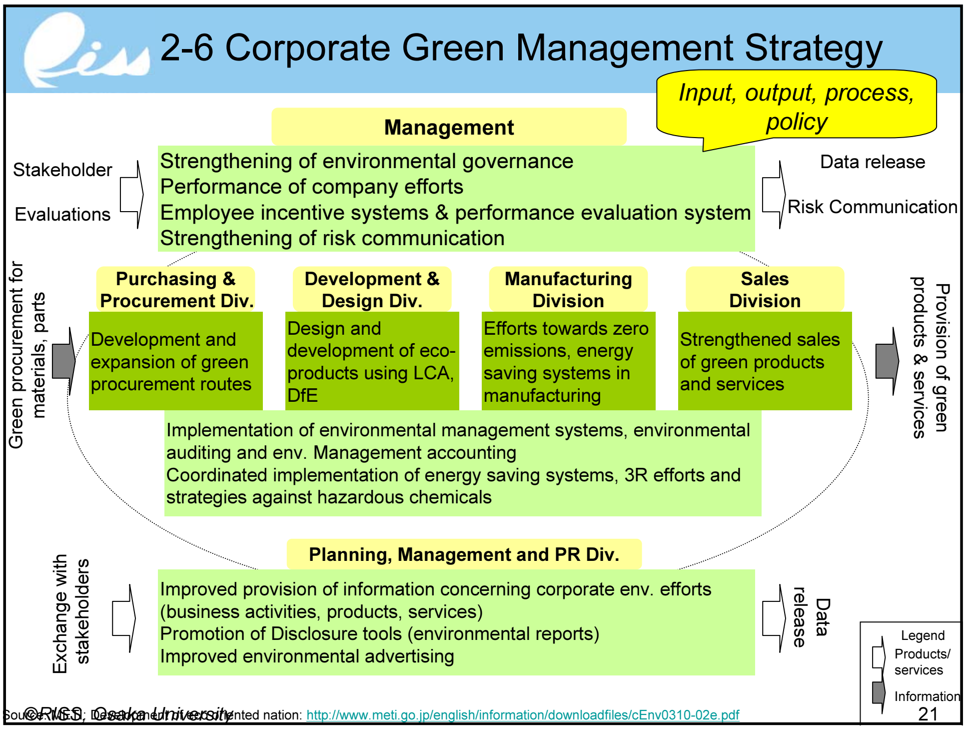
2-6 Corporate Green Management Strategy
Input, output, process, policy
Management
Stakeholder
Evaluations
Strengthening of environmental governance
Performance of company efforts
Employee incentive systems & performance evaluation system
Strengthening of risk communication
Data release
Risk Communication
Green procurement for materials, parts
Purchasing & Procurement Div.
Development and expansion of green procurement routes
Development & Design Div.
Design and development of eco-products using LCA, DfE
Manufacturing Division
Efforts towards zero emissions, energy saving systems in manufacturing
Sales Division
Strengthened sales of green products and services
Provision of green products & services
Implementation of environmental management systems, environmental auditing and env. Management accounting
Coordinated implementation of energy saving systems, 3R efforts and strategies against hazardous chemicals
Planning, Management and PR Div.
Exchange with stakeholders
Improved provision of information concerning corporate env. efforts (business activities, products, services)
Promotion of Disclosure tools (environmental reports)
Improved environmental advertising
Data release
Legend
Products/ services
Information
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http://www.meti.go.jp/english/information/downloadfiles/cEnv0310-02e.pdf
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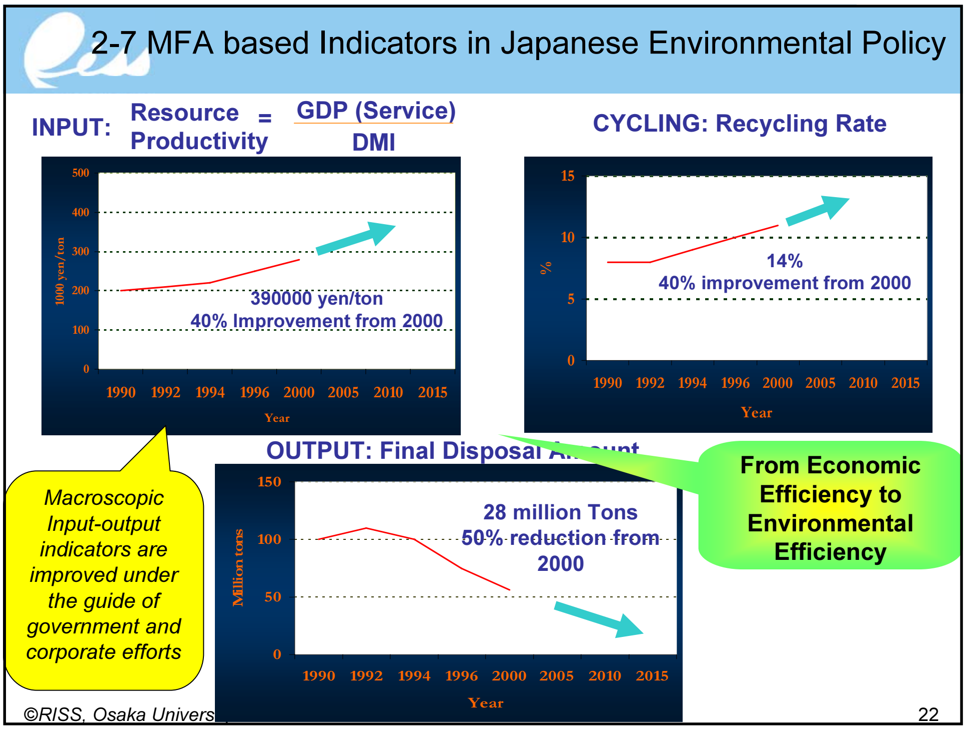
2-7 MFA based Indicators in Japanese Environmental Policy
INPUT: Resource Productivity = GDP (Service) / DMI
1000 yen/ton
500
400
300
200
100
0
390000 yen/ton
40% Improvement from 2000
1990 1992 1994 1996 2000 2005 2010 2015
Year
CYCLING: Recycling Rate
%
15
10
5
0
14%
40% improvement from 2000
1990 1992 1994 1996 2000 2005 2010 2015
Year
OUTPUT: Final Disposal Amount
Million tons
150
100
50
0
28 million Tons
50% reduction from 2000
1990 1992 1994 1996 2000 2005 2010 2015
Year
Macroscopic Input-output indicators are improved under the guide of government and corporate efforts
From Economic Efficiency to Environmental Efficiency
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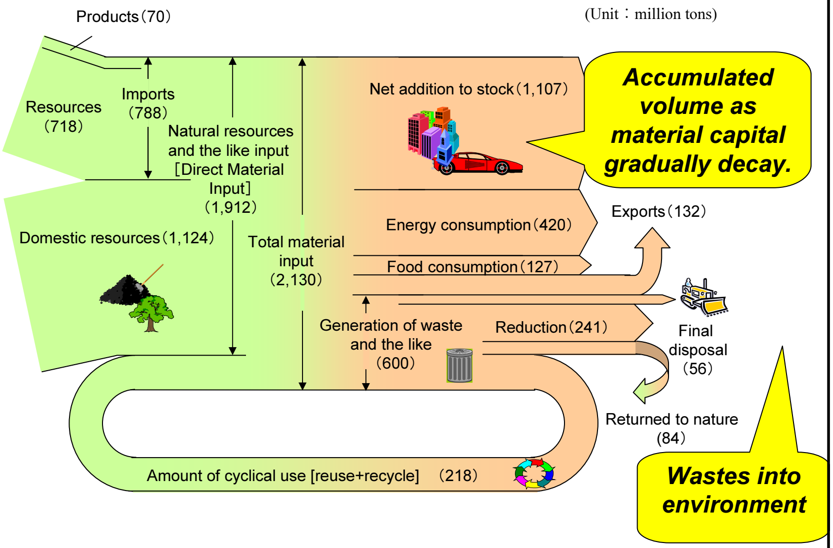
2-8 Material Flow in Japan



Ministry of the Environment: Fundamental Plan for Establishing A Sound Material-Cycle Society, <http://www.env.go.jp/en/rep/waste/plan_sound.pdf>

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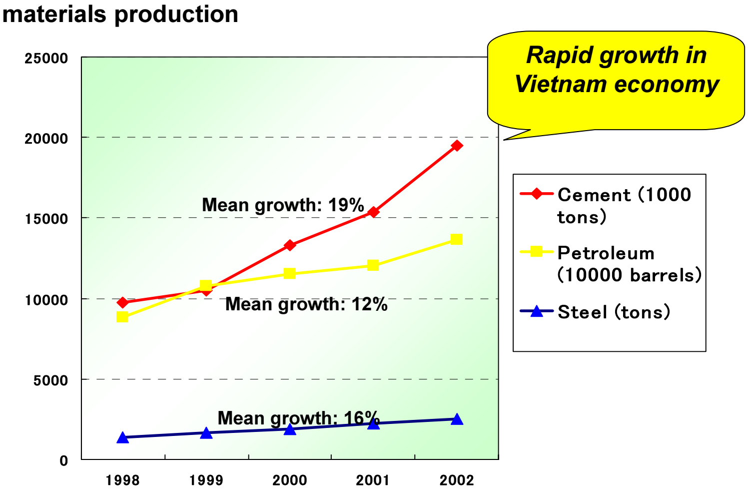
2-9 Vietnam: Production of mineral commodities

A good indicator of the increasing industrial activities in Vietnam is the trends in basic materials production



Data source: John C. Wu (2002) The mineral industry of Vietnam

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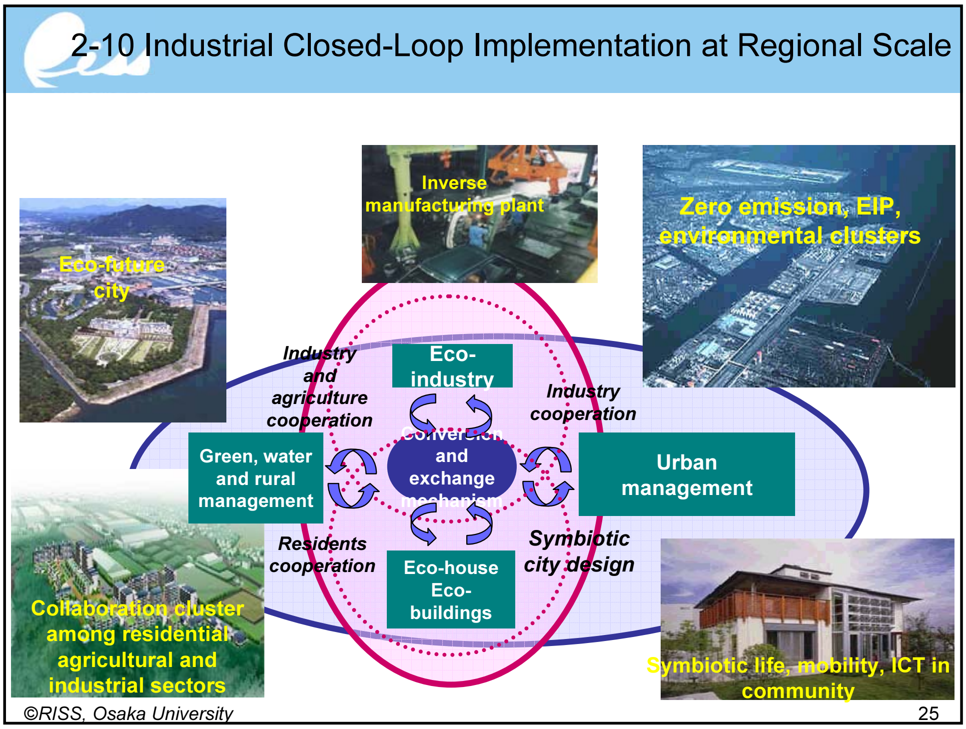
2-10 Industrial Closed-Loop Implementation at Regional Scale
Inverse manufacturing plant
Zero emission, EIP, environmental clusters
Eco-future city
Eco-industry
Industry and agriculture cooperation
Industry cooperation
Green, water and rural management
Conversion and exchange mechanism
Urban management
Residents cooperation
Symbiotic city design
Eco-house Eco-buildings
Collaboration cluster among residential agricultural and industrial sectors
Symbiotic life, mobility, ICT in community
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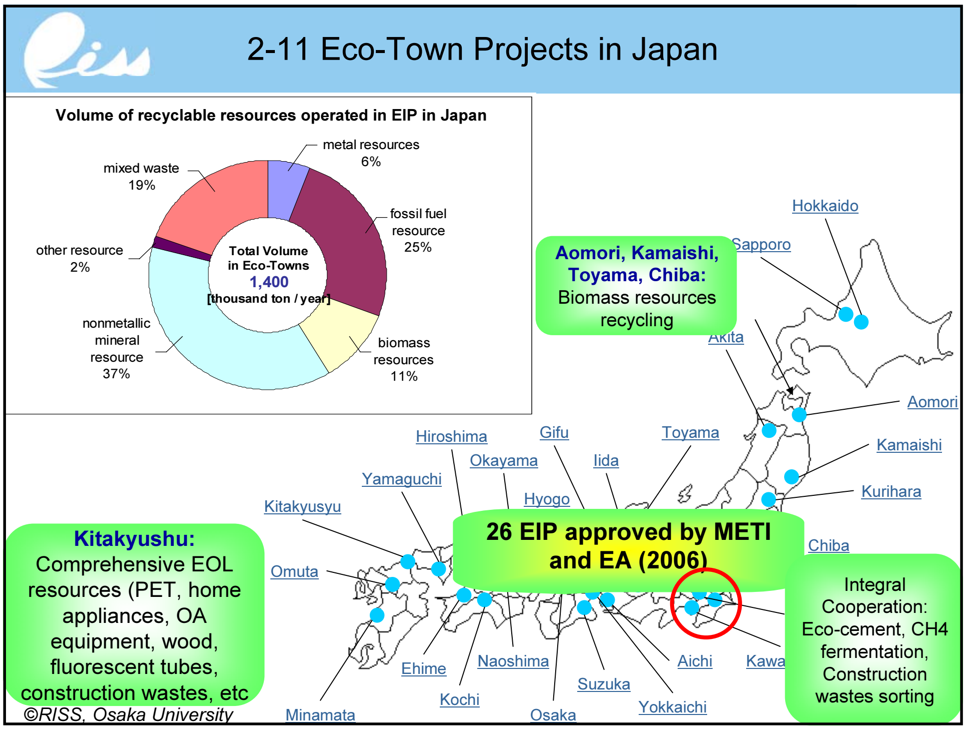
2-11 Eco-Town Projects in Japan
Volume of recyclable resources operated in EIP in Japan
metal resources 6%
mixed waste 19%
fossil fuel resource 25%
other resource 2%
Total Volume in Eco-Towns 1,400 [thousand ton / year]
nonmetallic mineral resource 37%
biomass resources 11%
Aomori, Kamaishi, Toyama, Chiba: Biomass resources recycling
Hokkaido
Sapporo
Akita
Aomori
Kamaishi
Kurihara
Hiroshima
Gifu
Toyama
Okayama
Iida
Yamaguchi
Hyogo
Kitakyusyu
26 EIP approved by METI and EA (2006)
Chiba
Kitakyushu: Comprehensive EOL resources (PET, home appliances, OA equipment, wood, fluorescent tubes, construction wastes, etc
Omuta
Integral Cooperation: Eco-cement, CH4 fermentation, Construction wastes sorting
Ehime
Naoshima
Aichi
Kawa
Suzuka
Kochi
Yokkaichi
©RISS, Osaka University
Minamata
Osaka

networking

2-12 EIP Initiatives in Asia

Country	Location
China	Dalian, Yantai, Soo Chow, Tianjin, Guiging, Yixing, Taihu, Shanghai, Chong Yuan, Guiyang and Jiangsu, Shi Hezi, Guigang, Nanhai, Quzhou, Zaozhuang, Lubei
Philippines	Laguna International Industrial Park, Light Industry and Science Park, Carmelray Industrial Park, LIMA, Laguna Techno park, Philippine National Oil Company Petrochem Industrial Park, Clean City Center project (USAID). GTZ project with PEZA & EPIC.
Indonesia	Lingkungan (LIK), Tangerang; Semarang; Industry Sona Maris
Malaysia	LHT resources linkage.
Korea	Master EIP Plan launched in 2003. Six proposals: Banwol Siwha, Mipo Onsan, Yeosu, Chungju, Jinhae Haman Jinju, and Pohang
Taiwan	Tainan Technology and Industrial Park, Changhua Coastal Industrial Park; CSS II (corporate synergy system II) projects, Hua Lian and Kaohsiung (2003) Taoyuan and Tainan Ta Shin 3/23/2004 (40,22,31,30 hectares)
Vietnam	**Amata (environment management), Hanoi Sai Dong II (feasibility study).**
Thailand	Industrial Estate Authority of Thailand plans (Map Ta Phut, northern region, Amata Nakorn, eastern sea-board, Bang Poo); Samut Prakarn province CPIE project; Bangkok (Panapanaan).
Singapore	Jurong Island Industrial Park

Source: IE Asia Conference (2001), EIE Asia Conference (2004), Bruce Chung, www.eco-industrial.net

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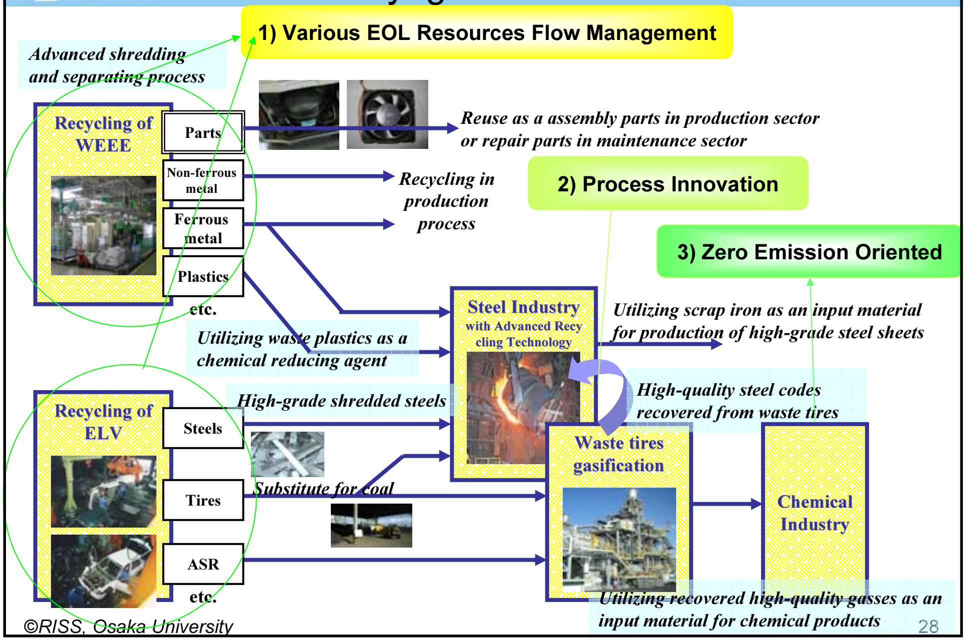
2-13 Design of advanced loop-closing system in Hyogo Eco-Town



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2-14 Sustainable Development :Socio-economic shared responsibility

Three principles of pollution responsibility

- **Polluter Pays Principle**
  "A principle under which users and producers of pollutants and wastes should bear the responsibility for their actions. Companies or people that pollute should pay the costs they impose on society"
- **Extended Producer Responsibility**
  "*An environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of the product's life cycle* " **(OECD)**
- **Shared Responsibility for Indirect or Shadow Effects**
  "All partners in the production and consumption chain have a role to play in their particular part of this chain" **This approach is not established in spite of RoHS, EuP, or REACH in EU.**

In the Asian region, trade of goods as well as bads (= wastes) is of crucial components. However,

- **Division of international production**: Given that industrial products are manufactured in the manner of the division of labor at national or international level, these three principles are not sufficiently applied under the current regulation systems in Asia. (What if some parts of a product contain toxic substances that were produced in different countries? Who takes the responsibility?)
- **Inappropriate trade of wastes, recyclables, recycled**
  On the one hand, lack of monitoring capacity and the gray zone of regulations causes pollution a heaven issue; on the other hand, strict restrictions hinder necessary trade of wastes.
- **Capacity building and establishing of new systems**

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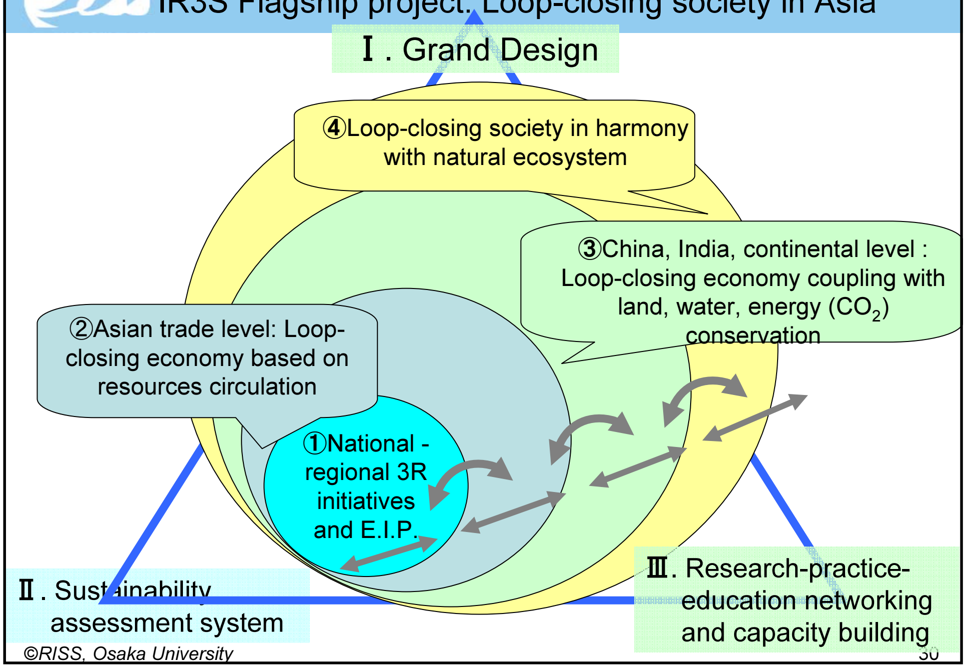
2-15 International Cooperation IR3S Flagship project: Loop-closing society in Asia



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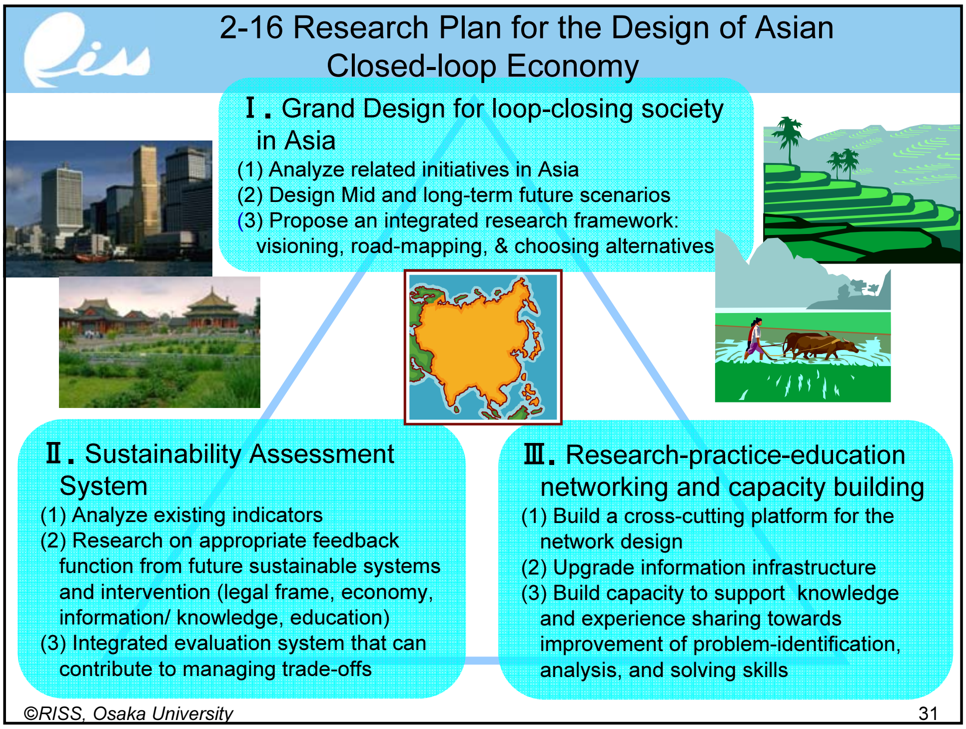

2-17 International Cooperation (Flagship Project: Loop-closing Society in Asia)

- Conceptualize the "Asian" loop-closing society (Economy).
  - Propose a future sustainable society: Visioning
  - Eco-industries development is the key to the establishment of sustainable metropolitan region which rapidly grow in Asia
- Dynamic scenarios are significant because:
  - the future desirable society will probably change over time.
  - Asian countries are closely related in their economies as well as the environmental issues.
- Integrated approaches to examine vision, alternative scenarios and road maps:
  - Need to establish the cooperative network not only for researchers from different disciplines but also researchers from different countries (including Vietnam, Japan, China, among others).
- Specification of R&D Mission
  - Local respect: 2030 society･･･ the path followed by industrialized and non-industrialized countries/region as well as coastal and inland areas will probably be different
  - Space, time scales, key variables in the specification!
  - The specification will help show how to go from scenarios to roadmap.

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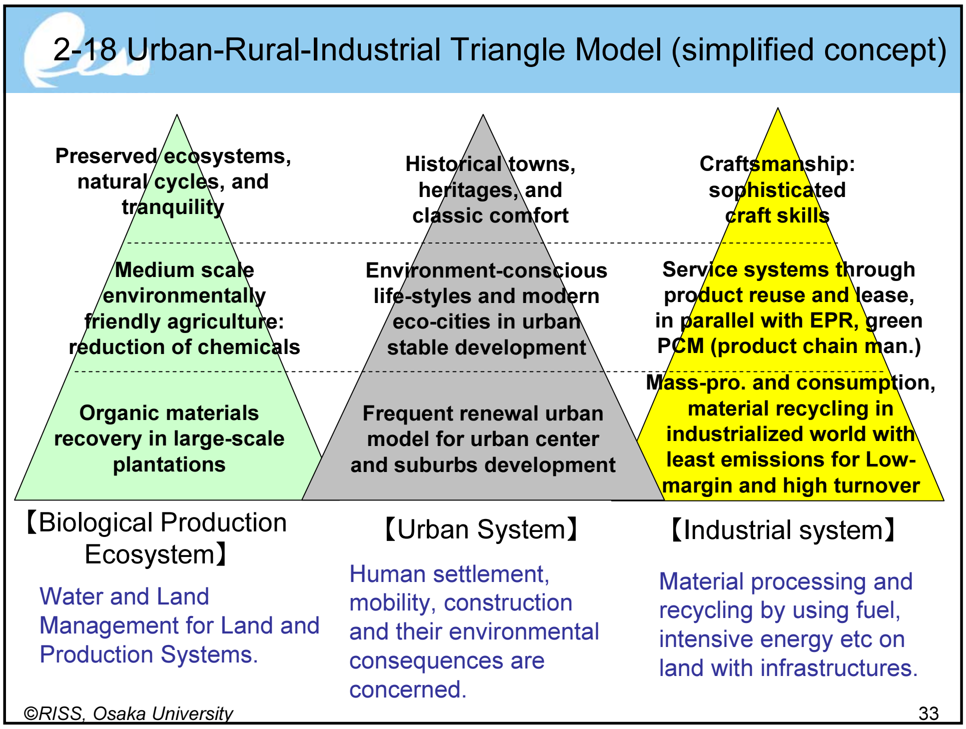
2-18 Urban-Rural-Industrial Triangle Model (simplified concept)
Preserved ecosystems, natural cycles, and tranquility
Medium scale environmentally friendly agriculture: reduction of chemicals
Organic materials recovery in large-scale plantations
Historical towns, heritages, and classic comfort
Environment-conscious life-styles and modern eco-cities in urban stable development
Frequent renewal urban model for urban center and suburbs development
Craftsmanship: sophisticated craft skills
Service systems through product reuse and lease, in parallel with EPR, green PCM (product chain man.)
Mass-pro. and consumption, material recycling in industrialized world with least emissions for Low-margin and high turnover
【Biological Production Ecosystem】
Water and Land Management for Land and Production Systems.
【Urban System】
Human settlement, mobility, construction and their environmental consequences are concerned.
【Industrial system】
Material processing and recycling by using fuel, intensive energy etc on land with infrastructures.
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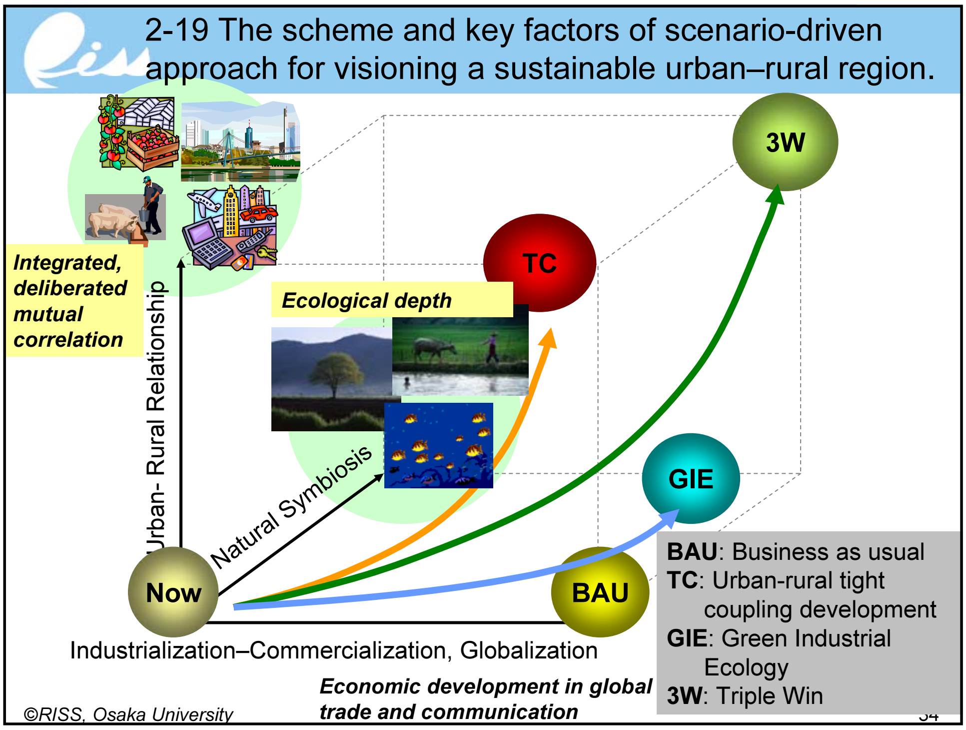
2-19 The scheme and key factors of scenario-driven approach for visioning a sustainable urban–rural region.
3W
TC
GIE
BAU
Now
Integrated, deliberated mutual correlation
Ecological depth
Urban- Rural Relationship
Natural Symbiosis
Industrialization–Commercialization, Globalization
Economic development in global trade and communication
BAU: Business as usual
TC: Urban-rural tight coupling development
GIE: Green Industrial Ecology
3W: Triple Win
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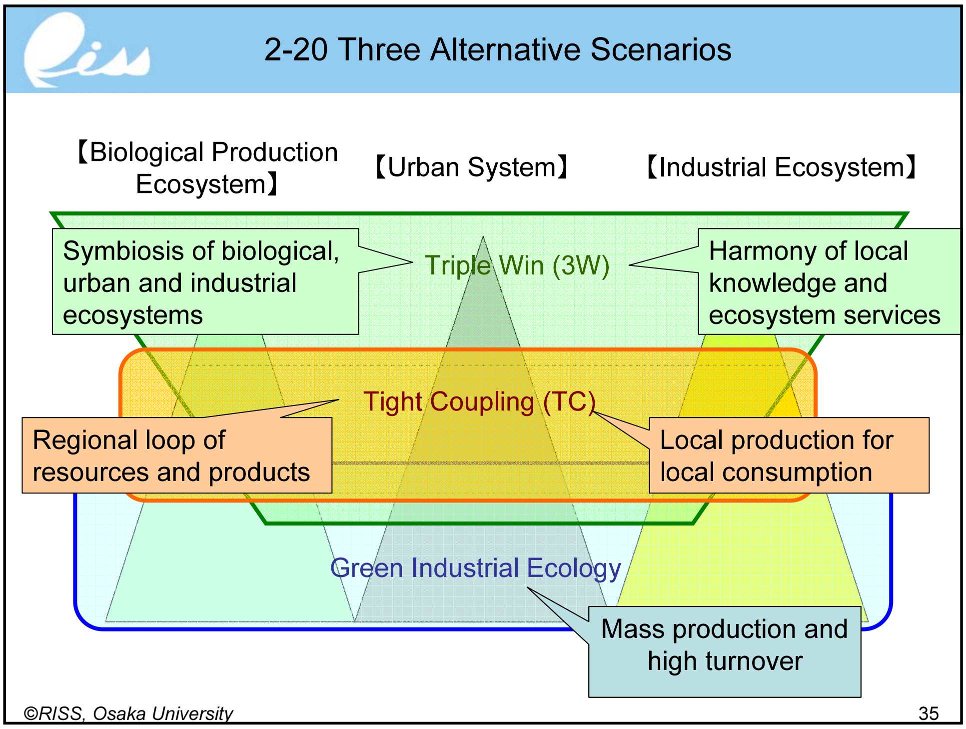
2-20 Three Alternative Scenarios
【Biological Production Ecosystem】
【Urban System】
【Industrial Ecosystem】
Symbiosis of biological, urban and industrial ecosystems
Triple Win (3W)
Harmony of local knowledge and ecosystem services
Tight Coupling (TC)
Regional loop of resources and products
Local production for local consumption
Green Industrial Ecology
Mass production and high turnover
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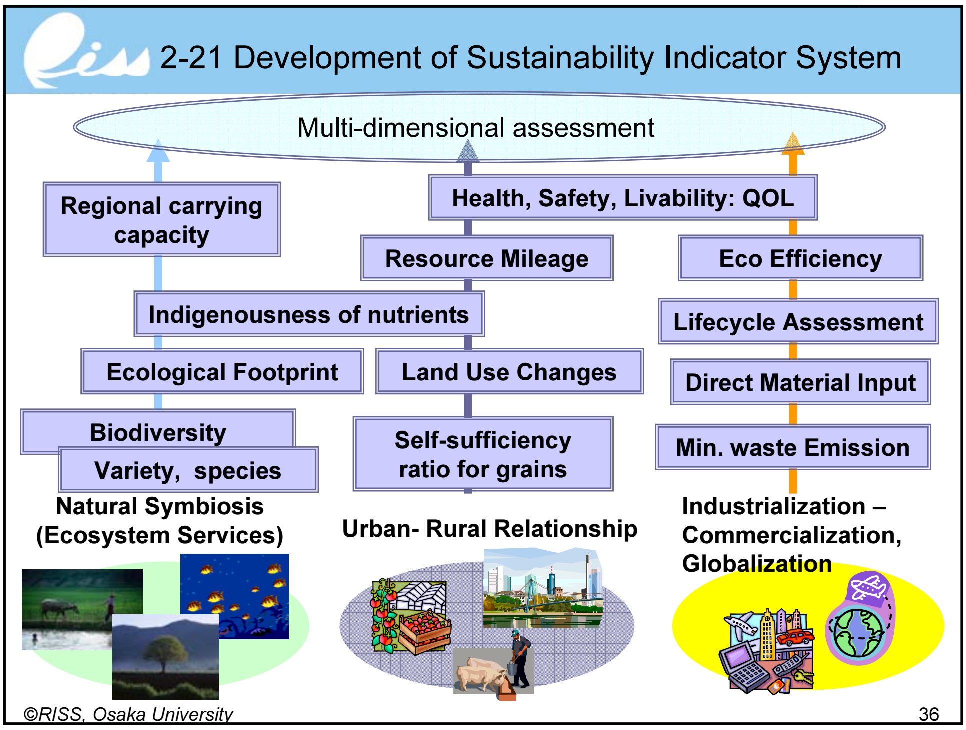
2-21 Development of Sustainability Indicator System
Multi-dimensional assessment
Regional carrying capacity
Health, Safety, Livability: QOL
Resource Mileage
Eco Efficiency
Indigenousness of nutrients
Lifecycle Assessment
Ecological Footprint
Land Use Changes
Direct Material Input
Biodiversity
Variety, species
Self-sufficiency ratio for grains
Min. waste Emission
Natural Symbiosis (Ecosystem Services)
Urban- Rural Relationship
Industrialization – Commercialization, Globalization
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2-22 Flagship Project - Research Proposal

① **Establishment of Asian Closed-Loop Economy**

- Differences from European Initiative: **Asian life style in Asian town/villa**
- Coupling economic development with sustainability: **Decoupling with burdens**
- Symbiosis with nature: **Water front and greenery for blue-green corridor**
- Dealing with trans-issues: population increase, poverty, climate change, biodiversity, water scarcity, etc :**Comparing eco-cities initiatives in China, etc.**
- Management of ELP or e-wastes distribution and specific attributions in closed loop (**Irregular or inappropriate reuse or trade, Spread of ITC technologies**)

② **Research scheme**

Implementation of international research collaborative project initiatives with Vietnam and China, with Korea and others

- Specification of **targeted case study areas; Ho Chi Minh, Hanoi in Vietnam**
- Necessity of **counterparts** in the case study areas
- Collection of data and analysis of case study areas (Social design, green industry promotion, environmental initiatives, current technology, current policy implementations)
- Fund for **continuing research**

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3. Sustainable & closed loop society in Ho Chi Minh City

- Introductory story:
Urban metabolism management and biomass industry promotion -

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3-1 Profiles of Vietnam

	Vietnam	Japan
Population (Agricultural pop)	83.5mil (53.7mil)	127mil (4.1mil)
Pop of Major Urban Area	HCM: 6 mil	Tokyo: 30 mil
GDP (Current US $ in 2004) (GDP per capita)	$ 42.2 bill ($ 549.8)	$ 3410 bill ($ 26,657)
Land Area (agricultural land)	32 mil h (6.7 mil h)	36 mil h (4 mil h)
Energy consumption (per mil people consumption)	1083.6 PJ (1995) (12.7 PJ)	22422 PJ (2004) (176 PJ)
Biomass energy (dry biomass)	842.3 PJ (444.5 PJ) Mostly wood	NA (3% of total energy supply in OECD)

This contrasts Japan where wet biomass share (sewage, livestock excretion) is high.

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3-2 Picture of HCMC

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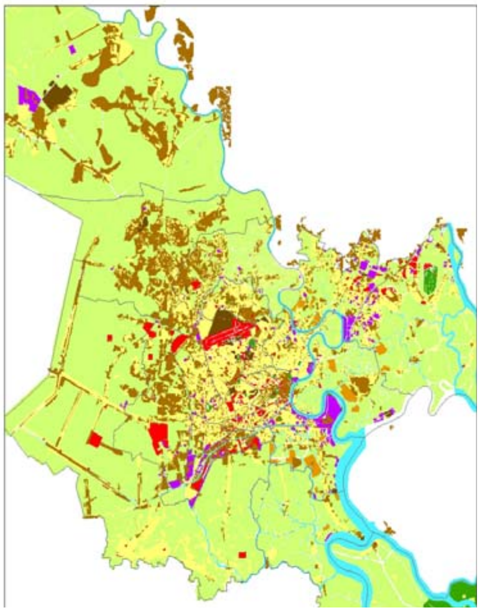
3-3 Urban district of HCMC



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3-4 Socio-economic condition - Population

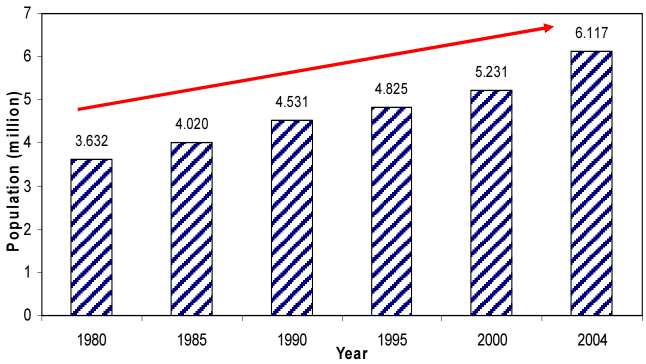

Fig. Population in Ho Chi Minh City (HCMC)

Source: (Dan, et al, 2005), Dan. N.P., Thanh.B.X., Khoa. L.V., and Truong.B.D. 2005. Country report-Groundwater Resource Management in Ho Chi Minh City

The city's official population has increased twofold over the past 25 years. The real population number is likely to be much higher than the figures, taking into account the unregistered people.

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3-5 Socio economic condition - Industrial activities

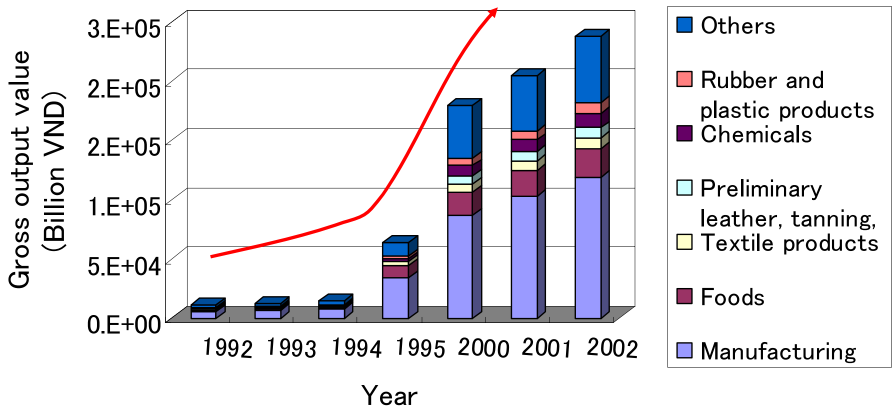

Fig. Gross output values of industries

Source: Based on statistical data in a study (Dan, et al, 2005,)

-Industrial activities have been vibrant recently, Manufacturing is a major sector of industrial activities in HCMC

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3-6 Solid wastes in HCMC

- Increasing solid wastes outputs:

  Daily, about 2,920 tons of domestic solid waste, 870 tons of construction waste, 170 tons of industrial waste generated in 2001. Industrial and hazardous wastes in HCMC was not studied in detail (DOSTE, 2001).

  DOSTE of HCMC (2001). The reports of environmental monitoring program under DOSTE/UNDP project – VIE 96/023, 2001

- Lack of final disposal sites:

  There are only two landfill sites with sanitary facilities in HCMC (*Go Cat* and *Tam Tan*). *Dong Thanh* landfill site was closed in 2001.

The concept of (3R) reduce, reuse & recycle will be required.

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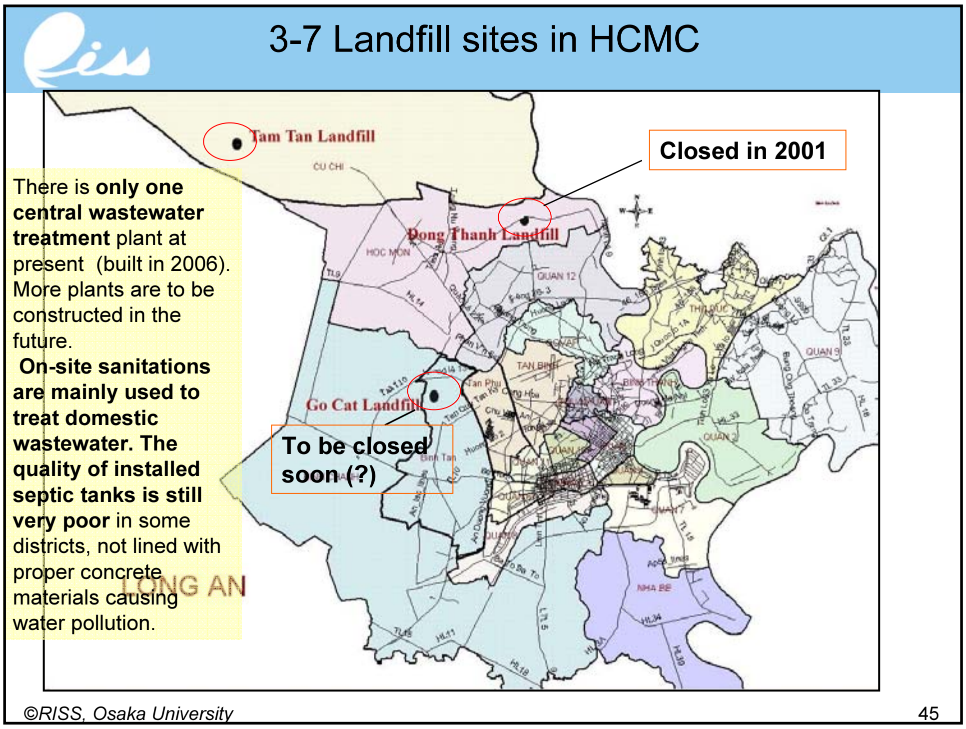
3-7 Landfill sites in HCMC
Tam Tan Landfill
Closed in 2001
Dong Thanh Landfill
Go Cat Landfill
To be closed soon (?)
There is only one central wastewater treatment plant at present (built in 2006). More plants are to be constructed in the future.
On-site sanitations are mainly used to treat domestic wastewater. The quality of installed septic tanks is still very poor in some districts, not lined with proper concrete materials causing water pollution.
LONG AN
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3-8 Master plan of Industrial park locations - HCMC
More activities to produce products and wastes
Legend:
Built IP
In progress IP
integration
Focus on zero emission and EIP promotion
CC
HM
D12
GV
TD
D9
TB
BT
D2
BC
D7
D8
NB
Tay Bac Cu Chi IP
Tan Phu Trung IP
Linh Trung II EPZ
Binh Chieu IP
North of Thu Duc IP
Linh Trung I EPZ
Tan Thoi Hiep IP
An Ha IP
Sai Gon Hi-tech Complex
Tan Binh IP
Vinh Loc IP
Le Minh Xuan IP
Tan Tao IP
Tan Thuan EPZ
Cat Lai IP
Phu My IP
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3-9 Current conditions in HCMC from the environmental viewpoint

- Rapid increase in economic activities and urbanization taking place in HCMC is and will be demanding a increasing amount of natural resources (water, energy, other raw materials).
- Urban and industrial activities are producing an increasing amount of solid wastes, while the final disposal sites will be lacking in near future.
- On the other hand, environmental facilities are lacking, resulting in various environmental pollution problems (water pollutions, increase in solid waste)

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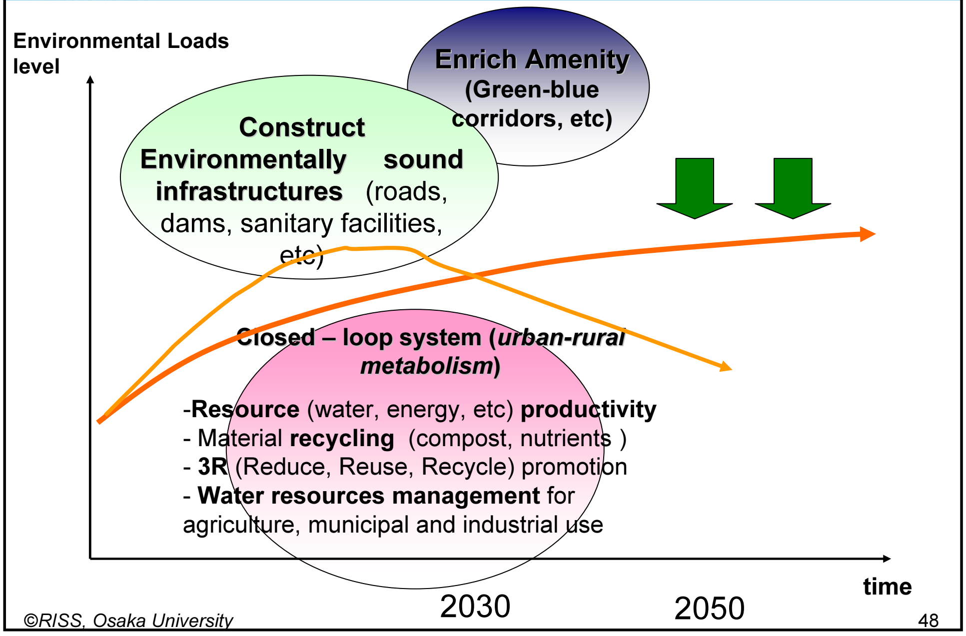
3-10 Basis for environmental sustainability in HCMC



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3-11 Toward sustainability of HCMC

1. Development of environmentally friendly infrastructures (sanitary facilities, landfill site, transportation, roads, dams, etc) and improvement of existing infrastructures are required.
2. Concept of Closed – Loop Society to reduce resource consumptions and wastes outputs will become important within city, city-suburban agricultural area, and industry (Water recycling, 3R program, biomass utilization, etc)
3. Amenity generation such as "blue and green corridors" (e.g. water front, green belt, etc) should be incorporated into the urban planning at this stage, while sound urban planning (e.g. zoning) need to be kept effective.

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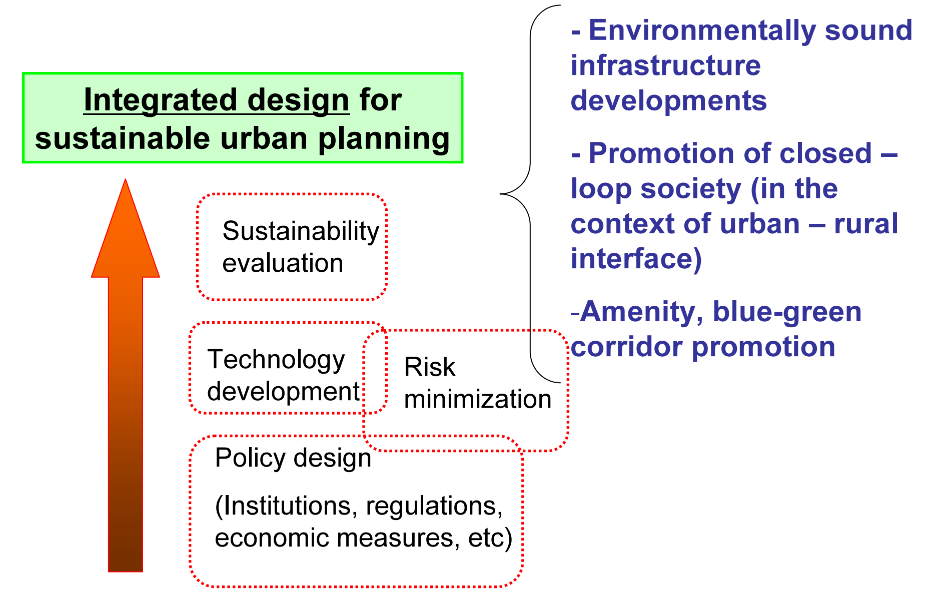
3-12 Study for sustainable & closed – loop society in HCMC



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3-13 Focus Areas of SCD Strategy

- Governance
- Poverty Alleviation
- Economic Development
- Environment, Tourism and Culture
- Water and Sanitation, Green Corridor
- Solid Waste Management
- Traffic and Transportation
- Health and Education
- Urban Finance

These are critical aspects for building a sustainable cities in Asia, including Vietnam.

(Sustainable City Development Strategy: SCDS)

Biomass utilization is one of cross-cutting issues

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3-14 Related initiatives to promote biomass

- Biomass Utilization under the Renewable Energy Development such as in Asian Regional Research Programme in Energy, Environment and Climate (ARRPEEC)
- Biomass Asia Initiatives by Japan Government, and also in Biomass Japan, 2002
- NEDO, Pre-Study on Possibility of Alternative Energy Development in Biomass Utilization in China, 2005
- USDOE-China MOA, Project Expert Team, Assessment of biomass resources availability in China, China Environmental Science Press, 1998

All of them may try to identify the vision, scenarios, and roadmaps regarding biomass utilization

=>> Tuong Nam Hai(IBT,VAST), Policy and actual situation on biomass utilization in Vietnam, Biomass-Asia Forum 2005, Tokyo, Japan, Jan. 19-21, 2006

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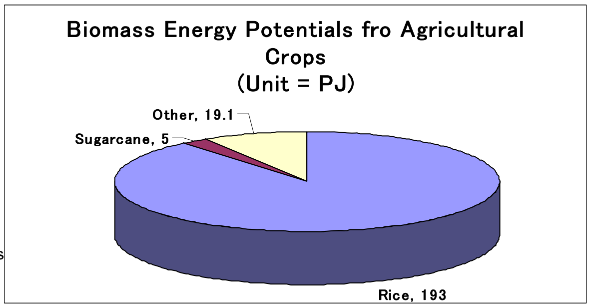
3-15 Vietnamese energy use and biomass energy

SOME FACTS

- **Low level but rapid increase in energy consumption**
  - **Economic growth and motorization are the attributes.**
- **Low share of fossil fuel in the energy source.**
  - **Mostly are from wood fuel and coal.**
- **Potential of biomass energy production from agricultural crops**



Source: "Decision support system for the application of renewable energy from biogas and biomass combustion"

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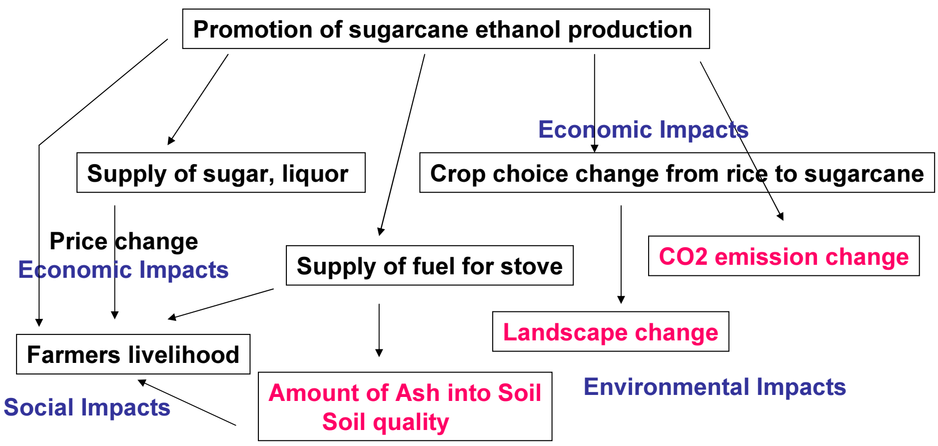
3-16 Promotion of biomass energy production - probable impacts -

Tuong Nam Hai introduced activities of MoET, Swedish Int. Dev. Coop. Agency and AIT(1997-2004), Netherlands(2003-2006), IE/MOI(2002-2004), IE/EVN(2003-2004).



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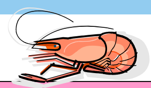
3-17 Biomass potentials in Vietnam: two examples



Oil/fuel or ethanol production using rice residuals (in South) or sugar-cane residuals (in Middle)

Rice is the largest crop products in Vietnam （34mil ton).
- Its residuals are large in volume.
- Its residual rate is also high (15%).

Utilization of shrimp residuals

- Exporting 80,000 tons of shrimp.
- Its residuals (head and organs) are sometimes used for feeding, but most causes pollution issues.

There are potentials; however…. >>> Development of Technology

Some challenges include:
- **Logistics**: Most rice mills are of small scale. It is not practical nor efficient that every small rice mill introduces biomass production machines.
- **Efficiency**: Usually, biomass production using wet residuals (i.e., shrimp head and organs) are inefficient.

→ **Cost reduction of collection, and more efficient utilization of wet residuals, and development of other usage are needed.**

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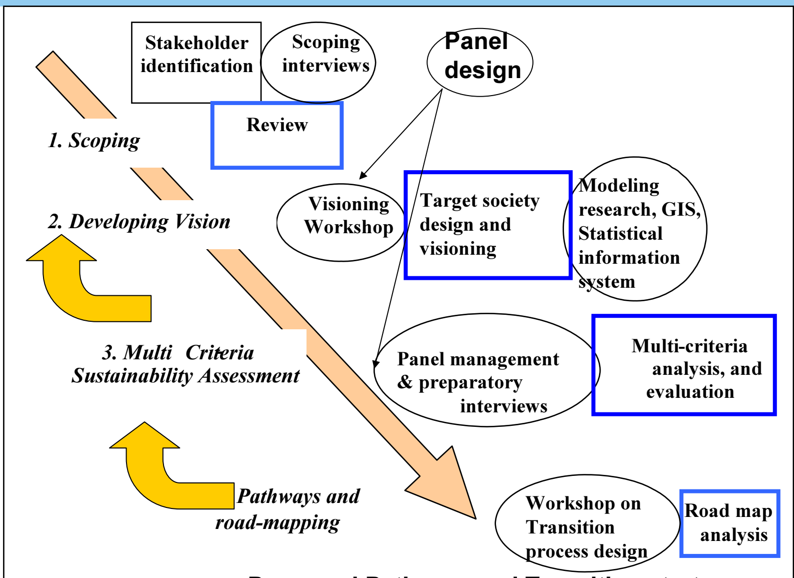
3-19 Expected scenario-driven approach to biomass utilization or other targets of sustainable region



Proposed Pathway, and Transition strategy

©RISS, Osaka University Applied from the frame of the UK Energy Team 56

3-18 Towards the Establishment of Biomass Society: Need social innovation in the four areas

Tuong Nam Hai pointed out the priority activities for sustainable development in agriculture in institutional, economic, and technological aspects.

1. Economic system
   - Policies that Induce the use biomass energy including a **pricing policy, and subsidies** for mitigating pollution from residual disposal, and one that rural areas can be better off from the promotion of biomass energy production and use.
2. Institutional system
   - Laws for logistics and consumers that make biomass energy production more efficient and induce the use of biomass energy **E10 or Bio-Diesel including eco-labeling and quality standard**.
3. Administration system
   - Urge regional administrations to propose **a region specific plan** that makes possible to **integrate agricultural production, logistics, fuel/energy production, and use.**
4. Cultural change and educational system
   - Environmental education that change people's view of biomass energy. **Capacity building approach**

Create employment, establish closed-loop society, and leading prosper culture in rural areas!

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Environmental Management in Industrial Development: Resources Conservation and Material Recycling Strategy in Vietnam

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University of Natural Sciences
Ho Chi Minh City-Vietnam

ABSTRACT: Choosing industrialisation as a key development strategy, Viet Nam is now facing with environmental challenges. Our generation has no right to get short term economic benefits, leaving long term environmental disasters to future generations. Measures to compromise economic and environmental goals should be considered. One among these measures is to organise industrial systems based on an industrial ecology approach. The main idea of Industrial Ecology is that for sustainable development, industrial systems should mimic natural ecosystems. In other words, the material cycles in industrial systems should be closed, similar to material cycles in natural ecosystems. The purpose of this paper is to analyse the advantages and constraints to apply the concept of industrial ecology, and to suggest some ideas to promote industrial ecology in Viet Nam

ENVIRONMENTAL MANAGEMENT IN INDUSTRIAL DEVELOPMENT: RESOURCES CONSERVATION AND MATERIAL RECYCLING STRATEGY IN VIETNAM

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Paper presented at The Conference on ' Sustainable Society and Industrial Transformation with Zero Emission Inititatives'
Ho Chi Minh City, Vietnam November 6-7, 2006

ENVIRONMENTAL MANAGEMENT IN INDUSTRIAL DEVELOPMENT: RESOURCES CONSERVATION AND MATERIAL RECYCLING STRATEGY IN VIETNAM

- INTRODUCTION
- INDUSTRIAL ECOLOGY: POLLUTION PREVENTION APPROACH
  - Industrial Metabolism
  - Industrial Ecosystem
  - Industrial Ecology
- INDUSTRIAL ECOLOGY IN PRACTICE
  - Denmark
  - USA
  - Canada
  - The Netherlands
  - Thailand
- INDUSTRIAL TRANSFORMATION IN VIETNAM: RESOURCES CONSERVATION AND MATERIAL RECYCLING

INTRODUCTION

- Industrial development challenges: natural resource scarcity, and environmental deterioration.
- End-of-pipe technologies are in general costly and do not provide any help to solve the problem of natural resource scarcity.
- Industrial Ecology: Preventive approach, new perspective to develop industrial systems towards ecologically sound direction.

INDUSTRIAL ECOLOGY: POLLUTION PREVENTION APPROACH

Industrial Metabolism

The metabolism of industry is the whole integrated collection of physical processes that convert raw materials and energy plus labour, into finished products and waste in a (more or less) steady-state condition

Industrial activities are not separated from the metabolism of the biosphere and that it is human economic and industrial activities that causes the problem of global change through their interfere in the ecological balance and natural cycles .

INDUSTRIAL ECOLOGY: POLLUTION PREVENTION APPROACH

Industrial Ecosystem

Natural cycles (of water, carbon/oxygen, nitrogen, sulfur, etc.) are closed, whereas industrial cycles are open.

Frosch and Gallopoulos (1989) **:** industrial systems should mimic ecosystems (the concept of industrial ecosystem).

The transformation of the traditional model of industrial activity, in which individual manufacturing takes in raw materials and generates products to be sold plus waste to be disposed of, into a more integrated system, in which the consumption of energy and materials is optimized and the effluents of one process serve as raw materials for another process.

Industrial Ecosystem concept focuses on the relations between companies in a direct waste/by-product exchange.

INDUSTRIAL ECOLOGY: POLLUTION PREVENTION APPROACH

Industrial Ecology

3 key elements of the industrial ecology perspective:

- It is a systemic, comprehensive, integrated view of all the components of the industrial economy and their relations with the biosphere.
- It emphasizes the biophysical substratum of human activities, i.e. the complex patterns of material flows within and outside the industrial system, in contrast with current approaches that mostly consider the economy in terms of monetary units.
- It considers technological dynamics as a crucial (but not exclusive) element for the transition from the actual unsustainable industrial system to a viable industrial ecosystem.

At the most basic level, the Industrial Ecology perspective describes a system in which one industry's wastes (outputs) become another's raw materials (inputs). Industrial ecology offers options which are not only effective for protecting the environment, but also for optimizing the use of scarce resources

INDUSTRIAL ECOLOGY: POLLUTION PREVENTION APPROACH

Industrial Ecology acknowledges the existence of a wide range of ***industrial ecosystems*** with varying degrees and patterns of interactions with the biosphere. Each industrial ecosystem is characterized by the flows of materials and energy ***(industrial metabolism)*** similar to those going through a natural ecosystem

INDUSTRIAL ECOLOGY IN PRACTICE

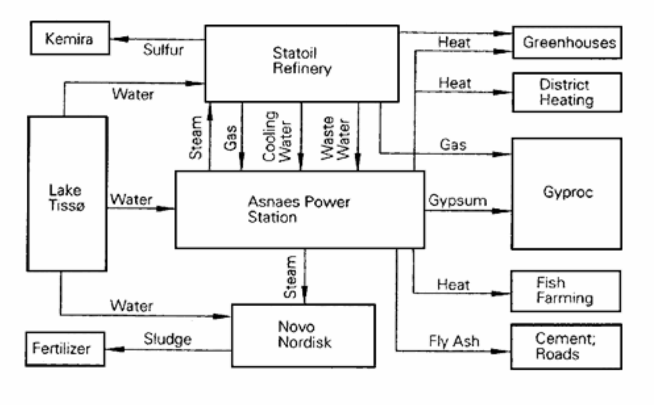
- Industrial symbiosis

  A group of industries work collaboratively through exchanges of materials, energy, water, and by-products to reduce natural resources consumption and pollution
- Industrial Ecosystem/Eco-Industrial Zone/Eco-park

  A community or network of companies and other organizations in a region or a physical zone/park who interact by exhanging and making use of by-products and/or energy in a way that provides one or more benefits over the traditional, non-linked operations. Those benefits include: reduction in natural resources use for input; reduction in pollution; reduction in energy use; reduction in disposal of wastes; increase in value of non-product outputs.

INDUSTRIAL ECOLOGY IN PRACTICE

Denmark: Kalundborg



INDUSTRIAL ECOLOGY IN PRACTICE

Denmark: Kalundborg

Investment 60 Million USD

Revenues of Participating companies 129 Million USD

Reduce air, water, soil pollution and reduce resource consumption at the same time.

Reduce 3,700 T/year SO_2 and 600,000 m^3/ year wastewater

Annual oil consumption was reduced by 45,000 T; coal consumption by 15,000 T

INDUSTRIAL ECOLOGY IN PRACTICE

USA

- Eco-Industrial Parks (1994): Baltimore (Maryland); Cape Charles (Virginia); Brownsville (Texas); and Chattanooga (Tennessee).
- Fairfield Industrial Park (Baltimore)
  - Carbon based economy
  - Producers with processes based on petroleum and organic chemicals (e.g. asphalt manufacturing and distribution, oil and chemical companies) and smaller companies which aid the larger producers (e.g. trucking, tire retreating, and box manufacturing).
  - A great opportunity for further cycling of organic compounds.
  - Retrofit industrial ecology principles to existing companies, and recruit companies that fit into the carbon-based economy.
  - Strategy is to welcome the following types of enterprises: manufacturing that fits with the current ecology (e.g. chemical companies, film/photo companies); environmental technologies; recyclers and waste exchanges.

INDUSTRIAL ECOLOGY IN PRACTICE

Canada: Burnside Industrial Park in Dartmouth

- Converting an existing, traditional park into an industrial ecosystem
- Diversity
- A research team identified a number of strategies, guidelines, potential symbiotic relationships and support systems
- Collaboration and networking at different levels:1) the university and the municipality 2) the university, the private electric utility company and governments 3) material exchanges between two or more companies; 4) establishment of new companies to take advantage of opportunities in reuse, rental, repair, remanufacturing and recycling.
- Factors of success: an interest in eco-industrial development, a willingness to participate, and a continuing commitment by a group of partners from government, industry, academia, and community organisations.

INDUSTRIAL ECOLOGY IN PRACTICE

The Netherlands: Rotterdam Industrial Ecosystem

Mixed industries: refineries, petro chemistry, industrial services, inorganic chemistry, mass goods, storage and transport

Reuse waste streams, by-products and energy from each other.

Arnhem, Den Bosch, Apeldoorn, Utrecht have developed « industrial estates towards the concept of industrial ecosystem by seeking the opportunities to exchange energy, raw materials, and water; to facilitate the common use of utilities, combining transport of goods and people, collective collecting and treatment of waste flows

INDUSTRIAL ECOLOGY IN PRACTICE

Thailand:Map Ta Phut Eco-Industrial Park

- Gas-related and heavy industrial complex: petrochemical plants, chemical & fertiliser plants, steel plants, electricity, steam, gas plants, and oil refinery plants .
- Develops a close loop between industries to promote the clean and green industrial development concept, to maximise the benefits from utilisation of natural resources and minimise the pollution problems, and to create the co-operation among the industrial operators, the local communities and the regulators

INDUSTRIAL TRANSFORMATION IN VIETNAM: RESOURCES CONSERVATION AND MATERIAL RECYCLING

Constraints	Advantages	Recommendations
-Lack of information on quantity and quality of waste streams	- Experience of factories in HCMC and DN in waste audit	-waste audit
-Pollution relating to waste recycling units -Low quality of products produced from waste -Low market demand for recycled products	-A number of waste exchange practices exist -Benefit from available reuse/recycle techniques -Viet Nam National Cleaner Production Center (VNCPC)	-Research fund -Collaboration between VNCPC- universities-developers

INDUSTRIAL TRANSFORMATION IN VIETNAM: RESOURCES CONSERVATION AND MATERIAL RECYCLING

Constraints	Advantages	Recommendations
-Lack of recyclers in industrial zones (IZs)	-Half filled IZs -Relocation program -Existing management structure for IZs	-Integrated waste exchange- relocation program
-Lack of concrete policy -Existing price system	-Environmental Law	-Economic incentives and disincentive policies -Adjustment of price system -Workshops/seminars/ trainings -Demonstration projects

Integrated Water Resources Management Strategies towards Sustainable Development

Prof.Dr. NAKAGAMI Ken'ichi (Ritsumeikan Asia Pacific University)

The growing population and pressure on the natural resources impair the natural processes of the water cycle resulting in shortages and declining quality of water resources. The practical approach to solving questions of water management is arguably the most pressing that the World faces in the early 21st century.

The Asia Pacific Region accounts for about 36 per cent of global run-off. Even so, water scarcity and pollution are key issues and the region has the lowest per capita availability of freshwater: renewable water resources amounted to about 3, 690 m3 per capita/year in mid-1999 for the 30 largest countries in the region for which records are available (UNDP, UNEP, World Bank and WRI 2000 and United Nations Population Division 2001).

Water scarcity, lowered quality and inadequate waste water systems are serious threats to the development of the Asia Pacific region. Water is essential to the region's growth. Water and waste water related problems will limit the region's options for the future. Traditionally, governments' policies and strategies on water management have been aimed at the expansion of supply in order to meet the ever-increasing water demands of the domestic, agriculture and industrial sectors. The largely fragmented approach that has traditionally been applied has allowed conflicts and competition, and has led to the over-exploitation of scarce water resources.

The current challenge for many countries of the region is to overcome fragmented sub-sector approaches and to design and implement integrated water resources management, particularly for the implementation of projects that transcend sub-sectors. (The above contents by Joint Research Project : Prof.Cooper, M.J.L,Fellizar,F.P.J and NAKAGAMI)

This paper focus on following three issues.

1. Sustainable Development and Environmental Resources

The concept of integrated environment-economic system, an approach to integrated water management which may serve as a point of departure for promoting the process of sustainable development.

a. Basic issues in the concept of sustainable development , b. Integrated environment-economic system

c. Integrated water resources management and environmental resources, d. Integrated water resources management as an alternative approach to sustainable development

2. Environmental Management and Sustainable Development in Vietnam

Vietnam joined ASEAN in 1955, the development of hard and soft infrastructure which contribute to Vietnam's economic development is well underway, and the industrialization and urbanization are rapidly progressing. The environmental management and integrated water management is need for making sustainable society in Vietnam.

a. Environmental pollution by urbanization, b. The urban environmental management and sustainable cities in Vietnam, c. Institutional framework for environmental management, d. The Red River Development Master Plan and sustainable urban development

3. International Network for Applied Research on Integrated Water Management

Recognizing the seriousness of water situation and the impending global water crisis, the Asia-Pacific Water Forum (Oct.2007, Beppu, Japan) was established during the recently concluded World Water Forum in Mexico, March 2006. This important body recognized that diversity is not an obstacle but rather an asset to the identification and adoption of solutions to specific water issues.

The Workshop on "Sustainable Societies and Industry Transformation with Zero Emission Initiatives,Nov.6.2006,Ho Chi Minh City,Vietnam

Integrated Water Resources Management Strategies towards Sustainable Development

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(Ritsumeikan Asia Pacific University)

1. Sustainable Development and Environmental Resources

a. Basic issues in the concept of sustainable development

Figure 1 Hierarchy of Policy Objectives

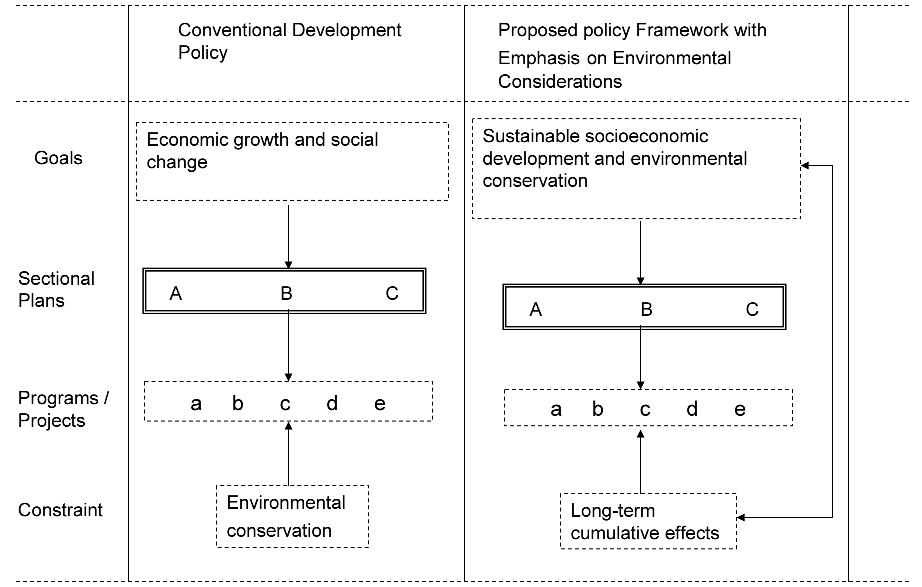


Figure 2 Environmental Management in Economic System

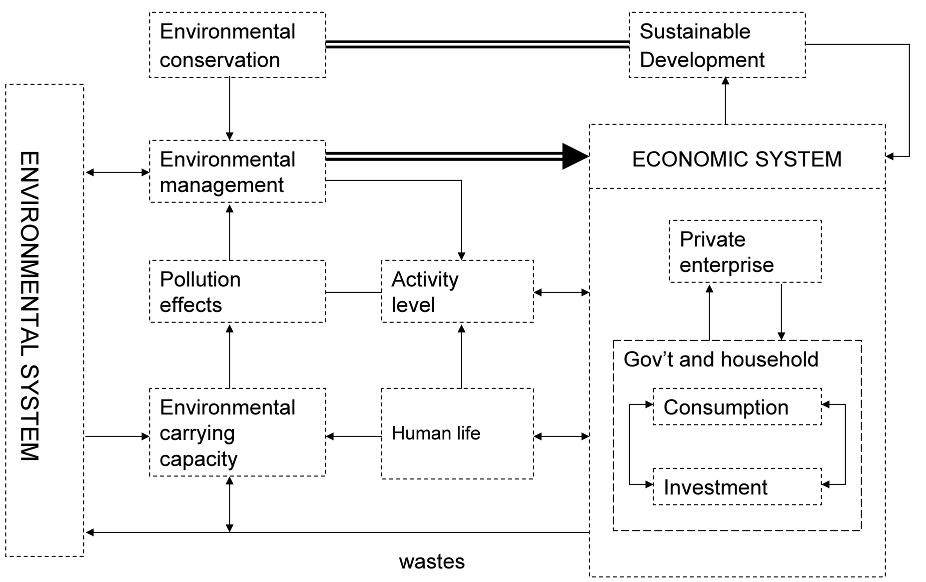
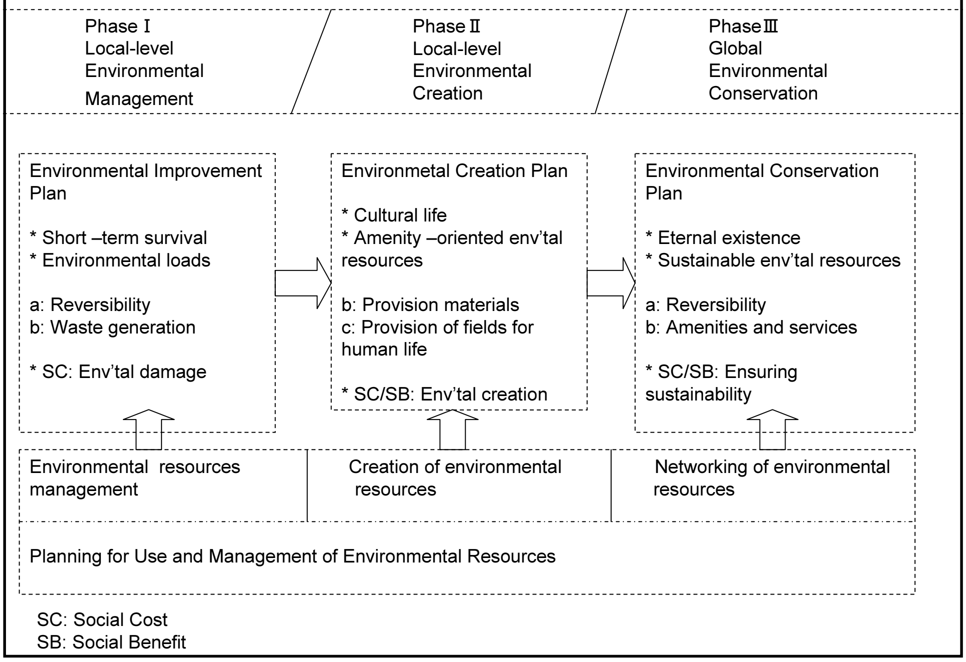


Figure 3 Global Environmental Conservation and Environmental Resources



b. Integrated environment-economic system

Figure 4 Integrated Perspective of Economic and Environment Systems

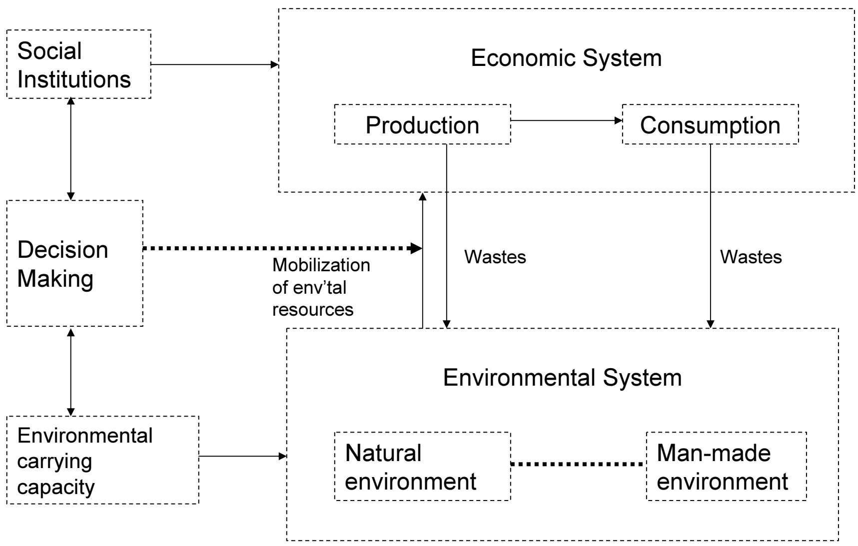
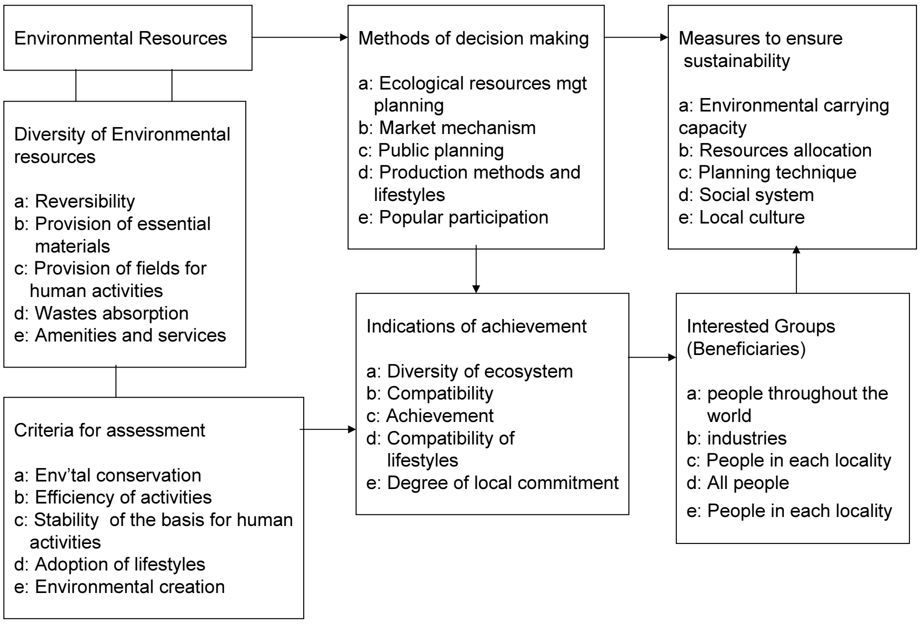


Table 1 A Framework of Environmental Resources

Environmental Management / Environmental Resources(ERs0	Environmental Improvement	Environmental Conservation	Environmental Creation
Natural / Ecological ERs	Natural disasters Soil pollution	Biosphere Natural landscape	Env'tal carrying capacity
Production activity-oriented ERs	Air pollution Water pollution Wastes	Lithosphere Water-sphere Atmosphere	Local energy
Urban activity –oriented ERs	Noise, vibration Odor Land subsidence	Spatial organization	Aesthetic resources
Socio-cultural ERs	Neighborhood pollution	Historical and cultural resources	Amenities and services

Figure 5 A Framework for Assessing Environmental Resources



c. Integrated water resources management and environmental resources

Figure 6 Integrated Water Resources Management

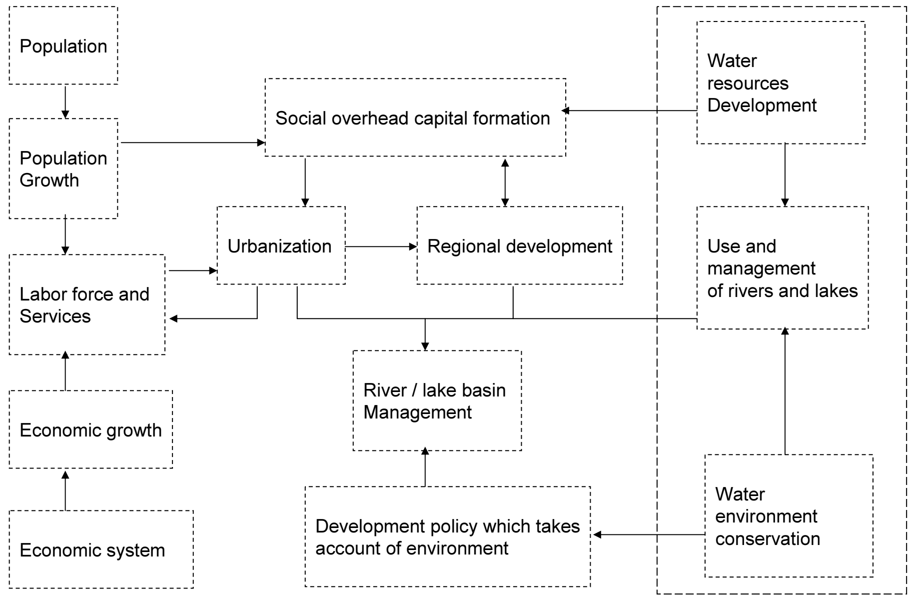


Figure 7 Management Action in the Basin Sub-systems

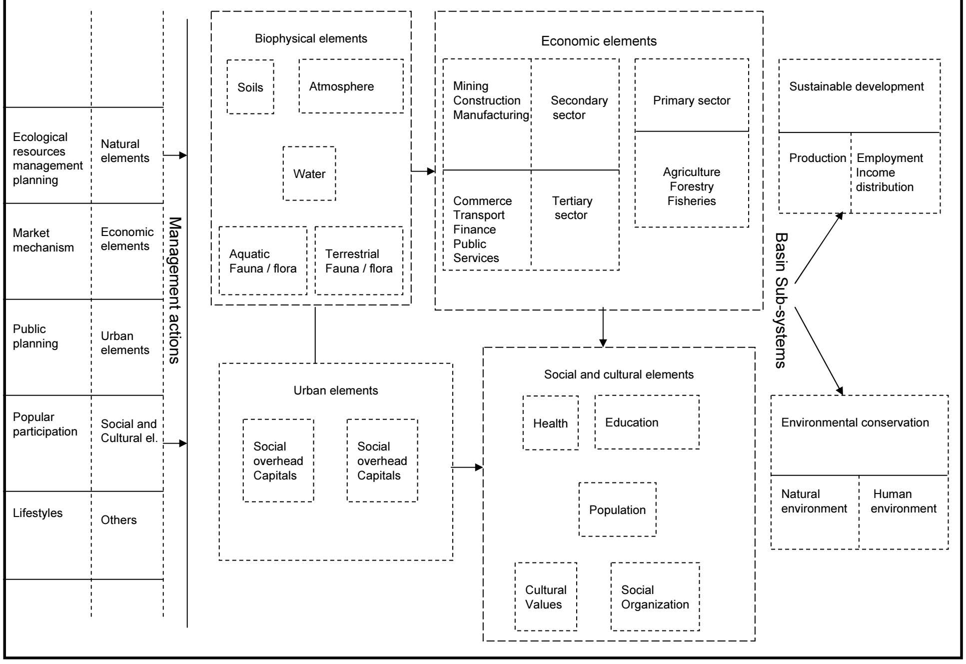


Figure 8 The Process of River / Lake Basin Management Planning

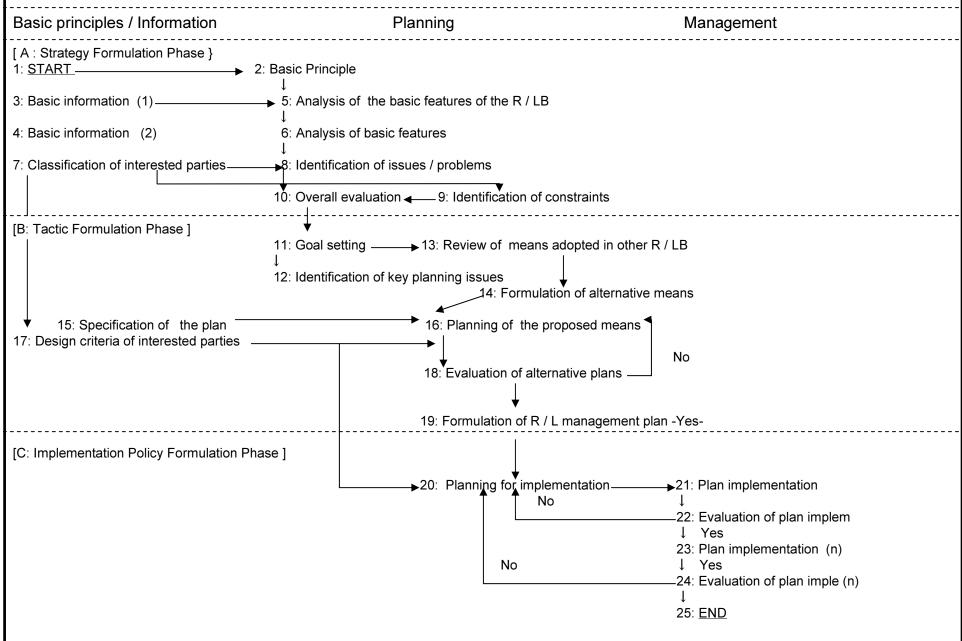
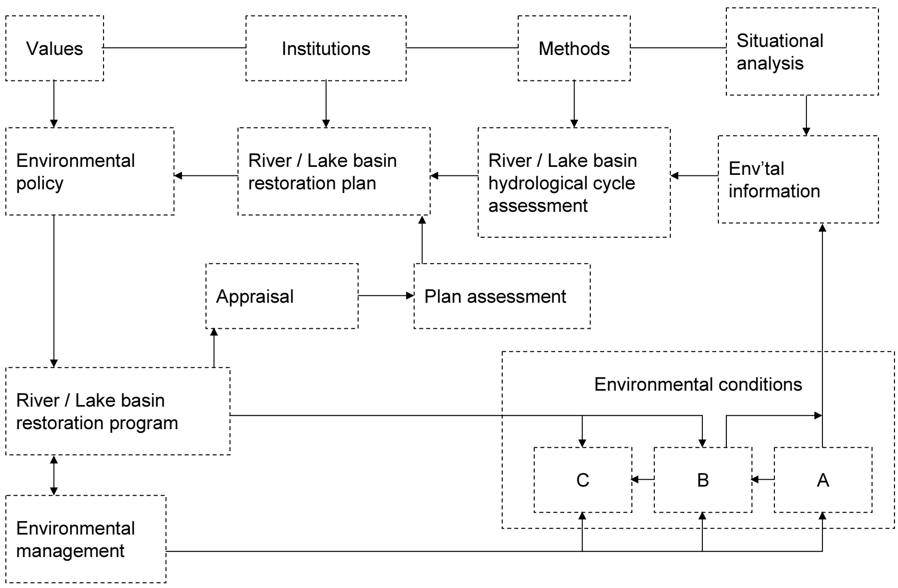


Table 2 Information Requirements and Criteria for River / Lake Basin Management

Management Action	Information Requirement	Criteria
Strategy formulation phase a) Natural elements b) Economic elements c) Urban elements d) Sociocultural el. e) Others	Basic information Basin structure Economic structure Urban structure Population structure Social institutions	Long-term consistency Stability of the basin Sustainability of the basin economy Healthy urban growth Balanced pop'n distribution Legitimacy of social systems
Tactic formulation phase a) Natural elements b) Economic elements c) Urban elements d) Sociocultural el. e) Others	Planning information River / Lake environments Industrial structure Social overhead capital Social structure Social institutions	Integrity River / Lake env't conservation Balanced industrial distribution Sufficiency of SOC Flexibility of social organization Conservation of environmental - carrying capacity
Implementation policy formulation phase a) Natural elements b) Economic elements c) Urban elements d) Sociocultural el. e) Others	Management information River flow condition Industrial location Land prices Educational system Wastes	Efficacy Stable water supplies Development of industrial sites Stability of land prices Promotion of culture and creativity-movement Appropriate waste management

d. Integrated water resources management as an alternative approach to sustainable development

Figure 9 A Generalized Framework for Environmental Management in a River / Lake Basin Context



2. Environmental Management and Sustainable Development in Vietnam

a. Environmental pollution by urbanization

The Discharge of Water of Water Contamination (unit: t/y)

	H_2SO_4	HF	H_2S	COD	LIGNIN	GREASE	N	P	SS
Viet Tri	2,000	542	45	2,000	362				
Bac Giang			212			20	447	126	1,219
Hai Phong						70			13,940
Hanoi						317			
HoChiMinh			65		68.5	796	4,045	763	45,691

Source: Ref No.3, Do Hoai Duong, et.al, "SCIENTIFIC BACKGROUND OF ENVIRONMENTAL MONITORING SYSTEM OF AIR AND WATER IN VIETNAM", "ENVIRONMENTAL PROTECTION AND SUSTAINAL DEVELOPMENT" Proceeding of the National Seminar on Environmental Protection and Sustainable Development Research, October, 1993

Water quality of the River (unit:mg/1)

Location	Do	BOD_5	NO^{3-}	PO_4^{3-}
Red River				
Hanoi	5.19	3.05	1.31	0.100
Viet Tri	6.31	2.75	1.98	0.051
Trung Ha	6.23	2.87	0.76	0.010
Son Tay	6.35	3.01	1.56	0.016
Co Tuyet	6.73	3.58	1.12	0.041
Mekong River				
Hong Ngu	6.6	12	0.10	0.10
Than Binh	6.8	8	0.10	0.10
Cao Lanh	6.2	15	0.10	0.10
My Tho	6.0	15	0.10	0.10

Source: Ref No.3, Time of sampling,13/6/1993
Do H0ai Duong, et.al, "SCIENTIFIC BACKGROUND OF ENVIRONMENTAL MONITORING SYSTEM OF AIR AND WATER IN VIETNAM", "ENVIRONMENTAL PROTECTION AND SUSTAINAL DEVELOPMENT" Proceeding of the National Seminar on Environmental Protection and Sustainable Development Research, October, 1993

b. The urban environmental management and sustainable cities in Vietnam

c Institutional framework for environmental management

d. The Red River Development Master Plan and sustainable urban development

Table 5-1 The characteristics of the Red river

Factors	Values
Catchment Area (km2)	169,000 (Inside 86,660 Outside 82,340)
Annual Discharge (km^3/year)	137 (Inside 92.88 Outside 44.12)
Monthly Discharge (km^3/year)	24.6 (Max/ann:18.0%)
Max	2.4(Min/ann:1.8%)
Min	1,141
Water Level (Son Tay) (cm)	2.61(mean) 3.45(highest)
Water Velocity (m/s)	188
Water Level Ruising Rate (cm/day)	37400(Max:1971)
Peak Discharge (Son Tay) (m^3/s)	

Source: WATER RESOURCES IN VETNAM, World Bank, ADB, IWRM, MAY1995

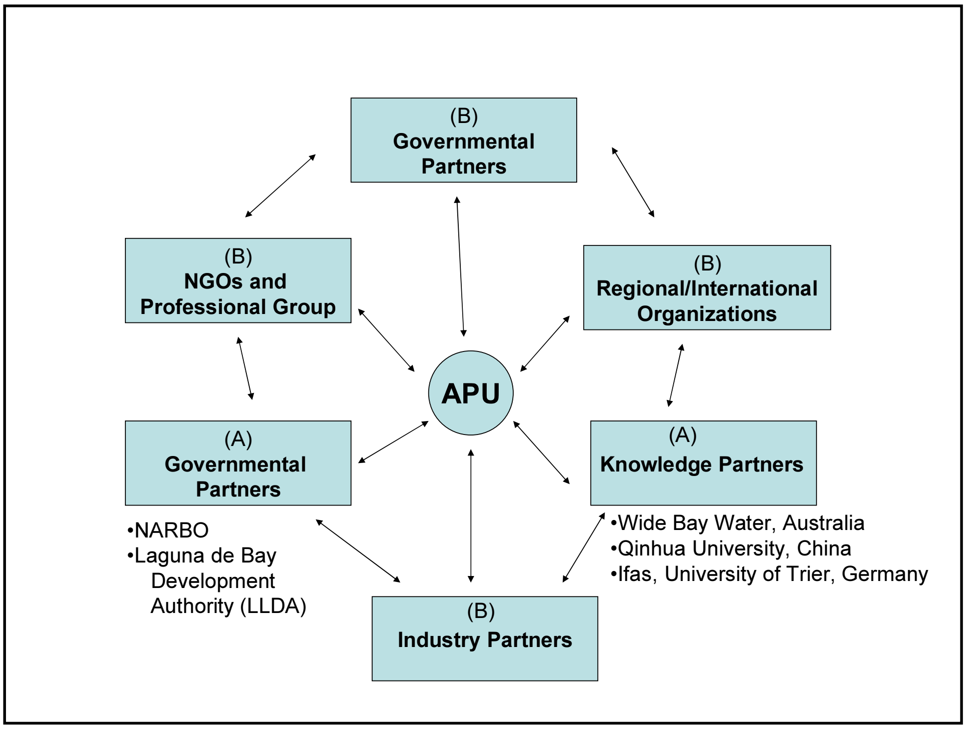
Prof. NUGUYEN VIET PHO, Dr. VU VAN THUAN, Evaluation, Management and Protection of Climate and Water Resources in Vietnam 1994

3. International Network for Applied Research on Integrated Water Management ----Asia-Australia-Europe Water Network---

a. Vietnam's environmental protection-oriented development and international environmental cooperation

b. International network for applied research on Integrated Water Management

----Asia-Australia-Europe Water Network---



The First Asia-Pacific Water Forum

(Oct.2007,Beppu, Japan)

Thank you for your attention!!

FROM WASTES TO BENEFITS TOWARDS ZERO INDUSTRIAL EMISSION IN HOCHIMINHCITY

Presented by Associate Professor, Doctor. Phan Minh Tan,
Director of Department of Science and Technology

I. Introduction

1. Specific characteristics of HoChiMinh City

HCM City has an area of approximately 2,094 square kilometers. It is located from 10^o 10’-10^o 38’ North and 106^o2’-106^o54’ East. The city has Binh Duong Province in the north, Tay Ninh Province in the northwest, Dong Nai Province in the east and northeast, Ba Ria-Vung Tau Province in the southeast, and Long An and Tien Giang provinces in the west and southwest.

Accounting for 0.6% of Vietnam’s total land area and 6.6% of the total population, HCM City is a part of the Southern Focal Economic Zone (SFEZ), which comprises the city, Dong Nai, Ba Ria-Vung Tau, Binh Duong, Long An, Tay Ninh and Binh Phuoc provinces.

HCM City is the country’s largest economic hub. As the most economically dynamic city in Vietnam, HCM City has always reported high levels of economic activity, constantly leading in terms of economic growth. With its gross domestic product (GDP) growth rate in 2004 reaching 11.6%, above the year’s target of 11.5%, the city registered the highest growth rate since 1998. The service sector increased 11.1%, construction and industry rose 15.1%, and contributed to 6% of the overall growth rate.

The city’s high economic growth makes it an important contributor to the country’s GDP. Its GDP accounts for nearly one-third of Vietnam’s total, and its GDP value in 2004 was more than VND131.5 trillion, as compared with the national GDP value of VND362.1 trillion. The State sector was the key player, making up 42.4% of the GDP, followed by the non-State sector with 38.9% and the foreign investment sector with 18.7%.

2. Industrial Development and Environmental Issues

In 2004, HCM City’s industrial production was more than VND102 trillion. The State sector accounted for the largest share with 37.5%, followed by the foreign investment sector with 35.3%. Major industrial products are garments, footwear, electricity, automobiles, electronics, food, mechanical products, motorcycles, plastics, rubber tires and computers.

Under the strategy for industrial development to 2010 and the vision for 2020, HCM City is expected to become an industrial city by 2015 and play the role as an economic driver of the southern focal economic zone and the whole country. Its share of the national GDP should make up 29.1% and national industrial production 29.1%. The GDP growth in 2006-2010 should reach 11.7% and the industrial growth rate an average 10%.

Key industries to receive priority for development are mechanical engineering, electronics, information technology and chemical.

By 2020, the total land area for industrial development will be 14,900ha, including 7,000ha for industrial parks and export processing zones. The investment for industrial development in the city from 2001 to 2020 is estimated at US$37.6 billion or 35-44% of the total investment capital.

Beside this rapid industrial growth, the are many environmental problems have been arisen. These industrial pollution problem could be defined as the followings:

- Industrial wastewater. Almost industrial establishments outside industrial parks in HCMC do not have wastewater treatment facility, and all wastewaters are discharged directly into sewers and drainage. There are 15 industrial parks, but most of them do not have wastewater plants yet. There are only two or three parks have installed the treatment facilities. Thus, the wastewater is the serious problem in HCMC. The forecast of industrial wastewater in Strategy of Environmental Management to 2020 is about 75,000 m^3/year of industrial wastewater discharged in to Dongnai river system.
- Hazardous and toxic waste. There are several industrial sectors which generate the hazardous and toxic waste during their production such as battery, chemical, pesticide, textile-dying production, and etc. The forecasts of hazardous waste to 2010 and 2020 are about 30,000 and 50,000 metric tons per year, respectively.
- Air pollution. There serious air pollution problems in HCMC is caused by traffic means, but there are also industrial air pollution. The most important source of air industrial pollution is from thermo-electric plants like Thu Duc, Hiep Phuoc thermo-electric plants. Beside there is still the air pollution from industries such as the exhaust from production processes.

II. Environmental Measures for industrial pollution reduction

1. Organizational Measure

Since 1994, the Vietnamese government authorities have issued several legal requirements on environmental protection. The names and levels of these requirements depend on agency who issues the requirements.

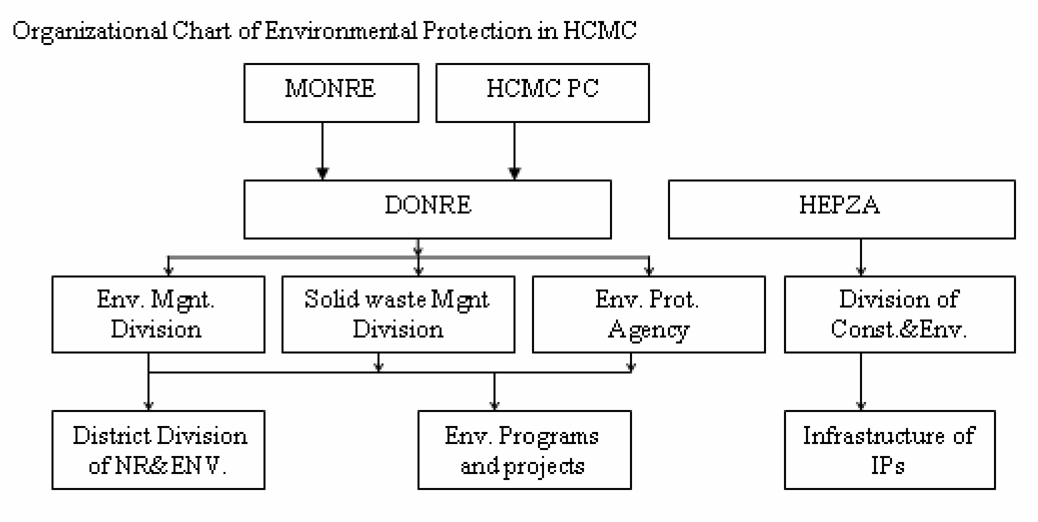
At the highest level there is the Resolution from **Political Bureau of Communist Party** – we have the Resolution number 36;

Vietnamese National Assembly, the highest organization has right to issue Assembly Resolution, and National Laws. The Vietnamese Assembly has approved the Law on Environmental Protection in 1995, and Revised Law on Environmental Protection in 2005.

After the Law on Environmental Protection has been effective, the State Government needs to issue the guidelines to implement the Law. The Guidelines issued by State Government are called differently, such as Decree, Decision. For example: there are several Decrees like Decree No. 175 on Guideline for Implementing the Law on Environmental Protection; Decree No.179 on Water Resources Protection, etc.

The Ministry of Science Technology and Environment (former) now is Ministry of Natural Resources and Environment has promulgated several Circulars and Decisions, such as Circular to guide Environmental Impact Assessment Report, Decision on National Environmental Standards, etc.

At the local level there is the Provincial Authorities called People's Committee (PC), and under PC is Department of Natural Resources and Environment which has to implement the requirements on environmental protection in the administrative boundaries.



2. Policies on industrial pollution reduction

HCM City has launched five large environment protection programs for the 2006-2010 period with the aim of helping the city harmonize economic growth with social progress for sustainable development.

These five programs will help remove all the seriously polluting industrial establishments from the city's interior, and treat 100% industrial and handicraft production establishments' effluent, 95% of ordinary solid waste, 75% of hazardous industrial waste, and 100% of medical waste in accordance with environmental standards.

The programs are believed to help clean the city as well as expand the average coverage of green area in the urban areas to 6-7 square meters per capita.

The city will set up a fund to provide assistance to waste recycling establishments, recognize environment-friendly products, and impose fines on polluting individuals and production establishments.

In addition, it has been conducting three programs to raise public awareness on environmental protection, to reinforce State management, and to intensify inter-regional and international cooperation on the issue.

The city will conduct a survey to collect data of industrial pollution and will classify production establishments by environment-friendly criteria.

A facility to deal with harmful industrial effluent is designed for construction and is expected to be put into operation in 1-2 years.

The city relevant agencies like HEPA (HoChiMinh Environmental Protection Agency), DoST, Research Institutions are studying to determine fee levels for several types of wastes, for example: fees for industrial waste water in accordance with Decree No 67 on the wastewater fees, and fee for hazardous wastes, and so on.

The city is intended to privatize the sector of waste disposal including household, industrial, and hazardous wastes. Now the are about 20 private companies for industrial waste disposal, and hundreds of citizen-held groups for collecting household wastes.

In addition, there is the research program under DoST for environmental protection and natural resources conservation, with billions of VND per year.

III. Towards Zero Industrial Emission in the future

1. Environmental Points of View for the Future

For the goal of sustainable development, the city should have a proper vision to the future and right policy to promote the environmental activities. And with the aim of Zero Industrial Emission, I would suggest the following thoughts to be implemented:

- Cleaner Production is an Effective Measure to minimize the waste and rationalize production process and materials. The city, especially the Department of Natural Resources and Environment has implemented many programs and projects on Cleaner Production such as UNDP, UNIDO, ADB project on Cleaner Production. The funds for Industrial Pollution Reduction, Recycling Fund for Cleaner Production have been established.
- Industrial Waste is the material resources for other production. There are several studies on the Industrial Waste to classify and determine which waste would be the material for the other production. The is a research on the feasibility to establish the waste market in HoChiMinh city. The city is intending to create a fund for waste recycling. In the Master Plan for Hazardous Waste, there is a plan to establish a Center for Waste Exchange.
- Up to date HCMC has 15 Industrial Parks (11 industrial parks, 3 export processing zones, and 1 high-tech park). The operation of these industrial parks leads to an idea to establish Ecological Industrial Park. It means no waste, or all waste is reused, recycled, including wastewater, industrial, and hazardous waste.

2. From Wastes to Benefits towards Zero Industrial Emission

With the point of view mentioned above, we could think of the change of wastes to benefits, to minimize the industrial waste towards zero industrial waste in the near future. To achieve this goal we should develop a program with the detailed steps. We would like to suggest a program with the following works:

- Baseline study on Industrial Waste. For a long time, we said there is about 800 large industries and 23,000 small scale units in HCMC, but the fact is not correct. The newest information from the Master Plan on Hazardous Waste, there is about from 4,000 to 6,000 industrial establishments including establishments inside and outside of the industrial parks. Therefore, we should make a study to determine how many are these industrial establishments, and what and how many are their wastes. Later we should develop a database on the industrial waste in the city.
- For the goal of reuse and recycle of industrial waste, we should make classification of the industrial waste and determine which waste could become materials for other production. For example, used lubricant would be an alternative fuel for cement kiln, or the waste from food processing would be a material for cattle-feed, and so on.
- To implement the exchange of industrial waste we should have a legal framework issued by HCMC PC. The framework should provide the rules and also the cost for the industrial exchange. The rules should contain who must participate the waste market, what waste is needed to be separated at source, what label, standards for waste container, and so on
- Establishment of Center for Industrial Waste Exchange. The is necessary to establish an organization to collect, classify, pre-treat for the goal of exchange. The organization should be called Center for Industrial Waste Exchange. The Center should be invested in collecting vehicles, the facilities for storage, pre-treat of the wastes for specific objectives.

IV. Conclusion

My presentation is not ambitious to present all the environmental problems in HCMC, there is the focus on the industrial waste, and the orientation to achieve zero industrial emission in the future. To affirm the points of view and to implement the steps mentioned above, the city should develop and implement several projects, and should call for more international assistance.

FROM WASTES TO BENEFITS TOWARDS ZERO INDUSTRIAL EMISSION IN HOCHIMINH CITY

Presented by Phan Minh Tân, Director of HCMC Department of Science and Technology

I. Introduction

1. Specific features of HCMC

- ✓ HCMC is located in the Northern Economic Focal Zone (including HCMC, DongNai, Binh Duong and BaRia_Vung Tau)
- ✓ An area of 2,095km2, 24 districts
- ✓ Population of 6,117,251 (Plus about 2 millions of immigrants)
- ✓ Contribution of 21% of GDP,29,4% industrial values, 37% export turn-over, 30% of total national budget income
- ✓ To 2010, the city will have population of 7,5 millions (exclude immigrants)

2. Industrial Development and Environmental Issues:

- 15 industrial parks (11 industrial parks, 3 export processing zones, 01 high-tech industrial park)
- Thousands of factories located in residential areas
- To 2020 the city expects to have 22 industrial parks and 24 zones for small and medium enterprises
- The city has program to remove heavily polluted industries out of the residence
- The main industrial products include food, textile-garment, mechanical, leather& shoe, electronic, and so on

Industrial environmental issues:

- **Industrial Wastewater pollution**
- ✓ **Almost on treatment facility**
- ✓ **2 or 3 industrial parks installed treatment plants**
- ✓ **75,000m3/year in 2020 to Dongnai river system**
- **Industrial hazardous and toxic wastes**
- ✓ **No disposal of industrial hazardous waste**
- ✓ **Discharge with wastewater or household waste**
- ✓ **About 30,000 to 50,000 ton/year to 2010 and 2020, respectively.**

II. Environmental Measures

National Assembly

- Environmental Protection Law 1995, and Revised 2005

State Government

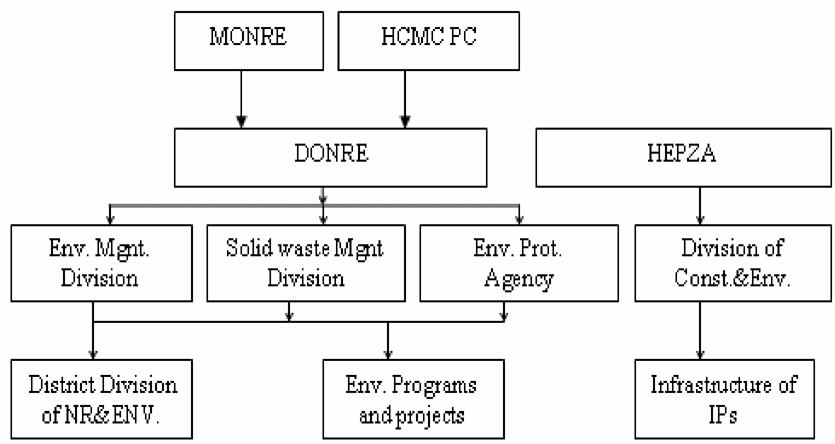
- Environmental Decrees, Instructions and Decisions from Prime Minister

MONRE, Other Ministries and HCMC

- Circulars and Decision to guide and implement Laws
- Environmental Standards on air, water, wastewater, urban solid wastes, hazardous wastes
- Regulations and Guidelines of HCMC and DONRE

II. Environmental Measures(cont.)

Organizational Chart of Environmental Protection in HCMC



II. Environmental Measures(cont.)

Five programs for pollution reduction:

1. Removing seriously polluting industries to planned zones
2. Fund for cleaner production, industrial pollution reduction, fund for waste recycling
3. Implement collect waste fees in accordance with Decree No.67
4. Public awareness
5. Increase the average coverage of green area to 6-7m^2/capita

III. Towards Zero Industrial Emission

1. Points of view

- **Production is an Effective Measure to Minimize industrial waste and rationalize production processes and materials.**
- **Industrial Waste is material resource for other production.**
- **Ecological Industrial Parks**

III. Towards Zero Industrial Emission (cont.)

2. Towards Zero Industrial Emission

- ☑ Baseline study on Industrial waste to identify, classify, and determine what, where and how many the industrial waste
- ☑ Classification and Pre-treatment to determine which Industrial waste could be the materials for the other production
- ☑ Legal Requirements for Exchange of Industrial waste to define the rules and cost for waste exchange
- ☑ Establish a Center for Industrial Waste Exchange

THANKS FOR YOUR ATTENTION

Plant-based Fuel Potential as a Renewable Energy Source

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One of the highlights of 2005 in my career was the opportunity to present a series of public lectures augmented by animated films and aromas at the 2005 World Exposition in Aichi, Japan. Theme of the sessions was "Exploring Earth's Treasures: Plant powers. The intention of my presentation is to allow citizens to learn closely about the seriousness of the global warming. The thread of this phenomenon would be widely accepted by learning a variety of events in the prehistory.

The most parts of the energy source we appreciate are originated from fossil fuels. Let's think about when those were produced and how many years it had been taken for their accumulation, and why the use of fossil fuels brings dramatic climate changes.

In a series of the EXPO activities, I found a unique picture painted by a geologist. I was very much shocked at the picture, which contains almost identical scenery that we often see. The environmental condition for nursing a variety of animals has been maintained for million years, but the inhabitants have not been always the same. The only way to produce a sustainable environment and a sustainable life is to accumulate know-how to a future life, which should allow us to be apart from our current life totally dependent on fossil fuels as energy source.

In this symposium let us find some solution to avoid the environmental deterioration and the shortage of food due to the global warming and huge increment in world-wide population. The developing countries soon follow the developed countries suffering from unpredicted problems. Therefore, we must offer an opportunity to public in order to consider oncoming problems and to let citizens know the limited potential of the earth. Therefore, we always keep in mind that our life as well as our society should be sustainable and many social problems deeply correlate with global energy problems and shortage of food.

Recently, huge waves of Biotechnology established in microbial and mammalian field surge over plant biotechnology field. Especially, molecular biology originally developed in such kingdoms has been applied to the plant science for creation of genetically modified (GM) plants. Plant biotechnology is getting popular not only in crop production but also in biomass production for industrial purposes.

However, several regulations on safety of GM Plants have been provided and this has suppressed the spread of GM plants for improvement of agricultural productivity in Japan. The public acceptance for GM plant must be established and a sort of negative reactions to avoid GM plants must be removed by means of providing proper scientific knowledge to citizen; we must accelerate basic researches to creation of useful GM plants as well.

In the near future, the population on the earth surely exceeds 8 billion and the essential requirements for life will be threatened in several ways, such as the short supply of food, the exhaustion of energy resources and the environmental disorders. To overcome such looming threats, we must develop powerful tools for biopower together with reconsideration of how to live a sustainable life endorsed by sophisticated and advanced technologies, definitely needed for plant biotechnology.

Such world-wide requirement for our future life encourages us to develop a new technique for creation of potential GM plants.

In Japan, the effort toward GM Plant creation in the commercial base is rather weak in comparison with the academic studies for plant biotechnology and plant physiology. Establishment of the core plant biotechnology applicable for GM Plants is long hoped for plant-based industry. Together with foreign gene transfer techniques for plant transformation techniques for chloroplast and plastids should be developed intensively. Additionally, organelles should be the next target to enhance plant potential useful for oncoming problems.

In this aspect, plant scientists must start the comprehensive researches covering genomics, transcriptomics, .proteomics, and metabolomics.

In my speech, I would like to talk about following items.

WHY*

1) Why we should switch from our current life style to a new one, mostly independent from fossil fuels.
2) Why Bio-power is able to solve environmental deterioration through eco-friendly know-how.

WHAT*

1) What aspect is expected in industrial plant production.
2) What problems the 21st century is facing to.

Through the social activity, such as this symposium, we will be able to consider the future of the earth more seriously, and we will have to predict the following 100 years and to prepare for unprecedented, unpredicted difficulties.

Plant-based Fuel Potential as a Renewable Energy Source

We need a new strategy for saving the earth

Akio KOBAYASHI
Osaka University
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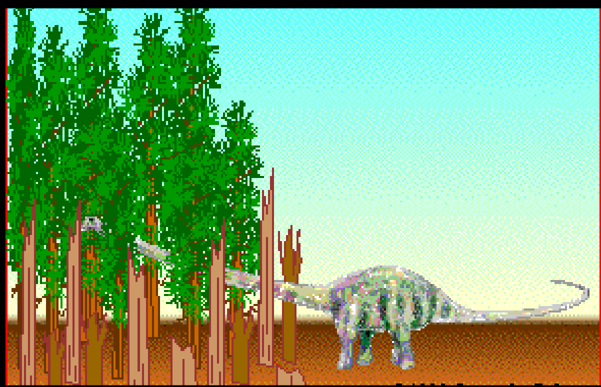
2005 world EXPO,
in Aichi, Japan

Public consciousness in Japan

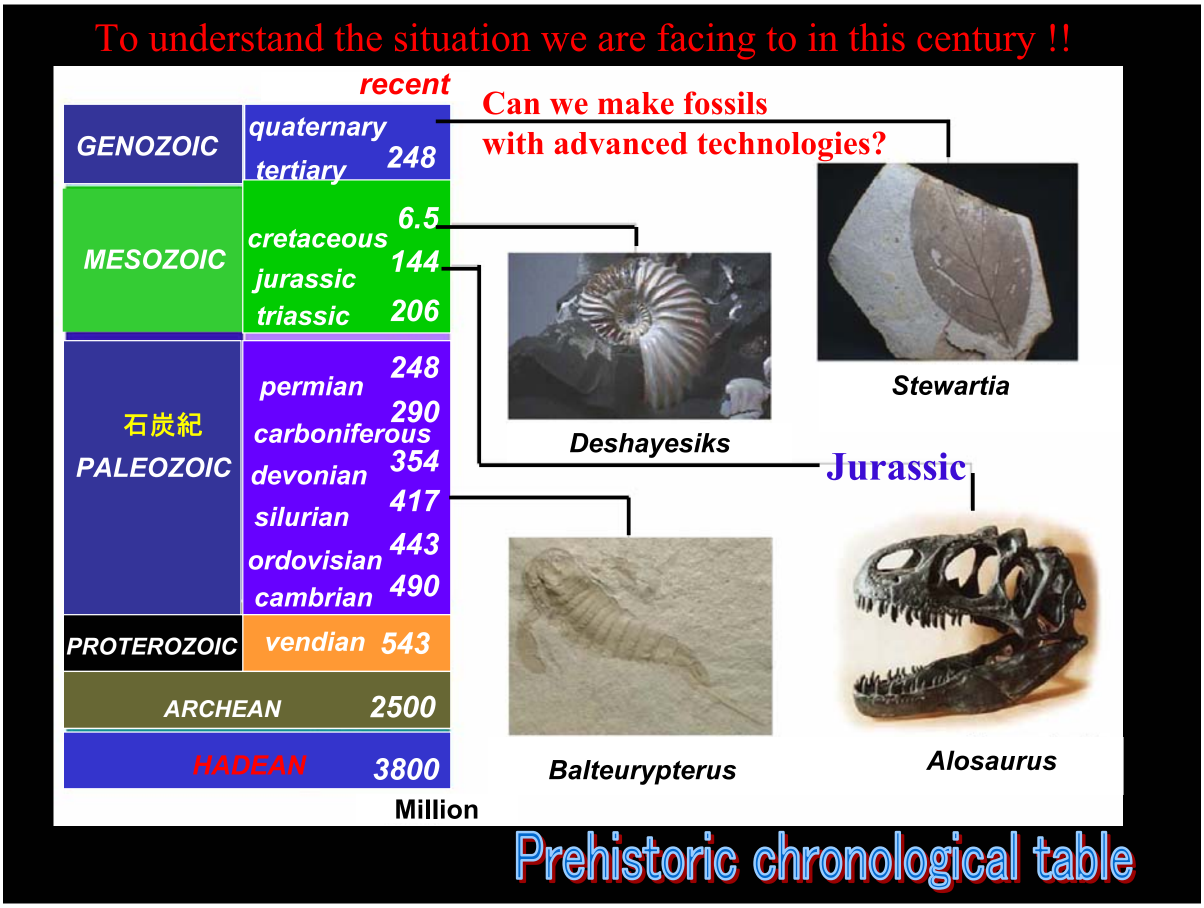
Key word

Global warming
Aging society



When did fossil fuels deposit? Why should we stop using fossil fuels?

- From the viewpoint of global warming
  we must substitute fossil fuels for other substitution, originated from plant sources.
- ***Rubber tree and Eucommia tree*** are unique woody plants which are capable to produce rubber.
- Under National Project, NEDO project, improvement of rubber production has been made by advanced plant biotechnology.


To understand the situation we are facing to in this century !!
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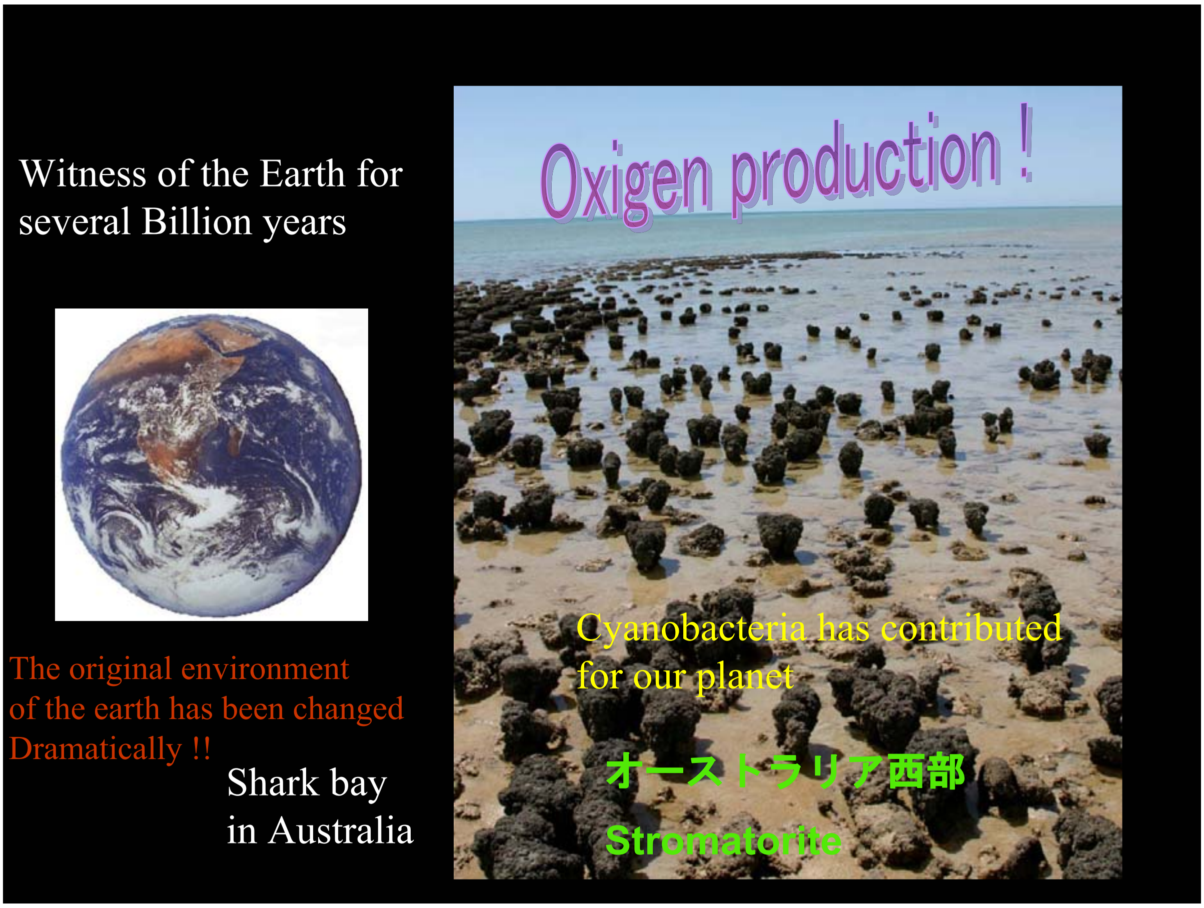
6.5
cretaceous
144
jurassic
triassic
206
石炭紀
PALEOZOIC
248
permian
290
carboniferous
354
devonian
417
silurian
443
ordovisian
490
cambrian
PROTEROZOIC
vendian 543
ARCHEAN 2500
HADEAN 3800
Million
Can we make fossils
with advanced technologies?
Stewartia
Deshayesiks
Jurassic
Balteurypterus
Alosaurus
Prehistoric chronological table

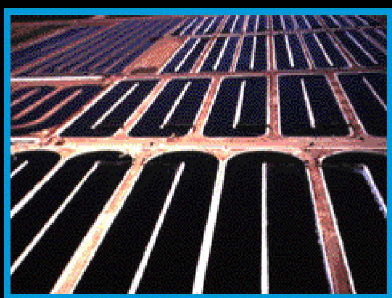

Witness of the Earth for
several Billion years
The original environment
of the earth has been changed
Dramatically !!
Shark bay
in Australia
Oxigen production !
Cyanobacteria has contributed
for our planet
オーストラリア西部
Stromatorite

Biological features of blue-green algae (cyanobacteria)

- *Oldest Photosynthetic prokaryote*
  World oldest fossils : 3.5 billion years old
- *Progenitors of chloroplast ?*
  Endosymbiont hypothesis
- *High adjustability toward environmental change*
  Desiccation tolerance, UV tolerance etc…
- *Unique secondary metabolisms*
  Allelochemicals, Bioactive compounds, Toxins

Industrial applications of cyanobacteria

- *Food supplement*
- *Bio-fuel*
- *Bio-remediation*
- *Source for novel bioactive compounds*



Large scale field culture of Σπιρυλινα sp.

Cyanobacteria would be found anywhere !

Unique features of terrestrial cyanobacterium, *Nostoc commune*

- Oxygen-producing photosynthetic microorganism
- Nitrogen-fixing capability
- Embedded within a dense glycan sheath
- Marked desiccation and UV tolerance
- Filamentous feature with gel-like products
- Co-residing with other organisms
- Produce unique bioactive compounds

Under microscope

Glycan sheath of *Nostoc commune*

— One of the most complex examples of bacterial sheath structures —

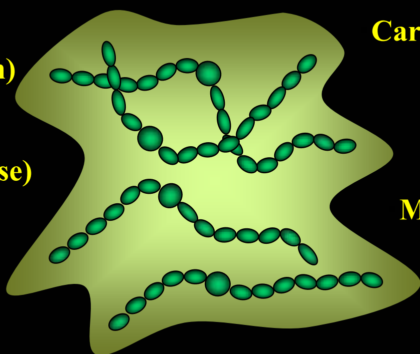
Water soluble UV-A, B absorbing pigment
(Oligosaccharide mycosporine amino acids)

Water stress protein (WSP)

Hydrophobic sunscreen
(Scytonemin)

Carbohydrate-modifying enzym

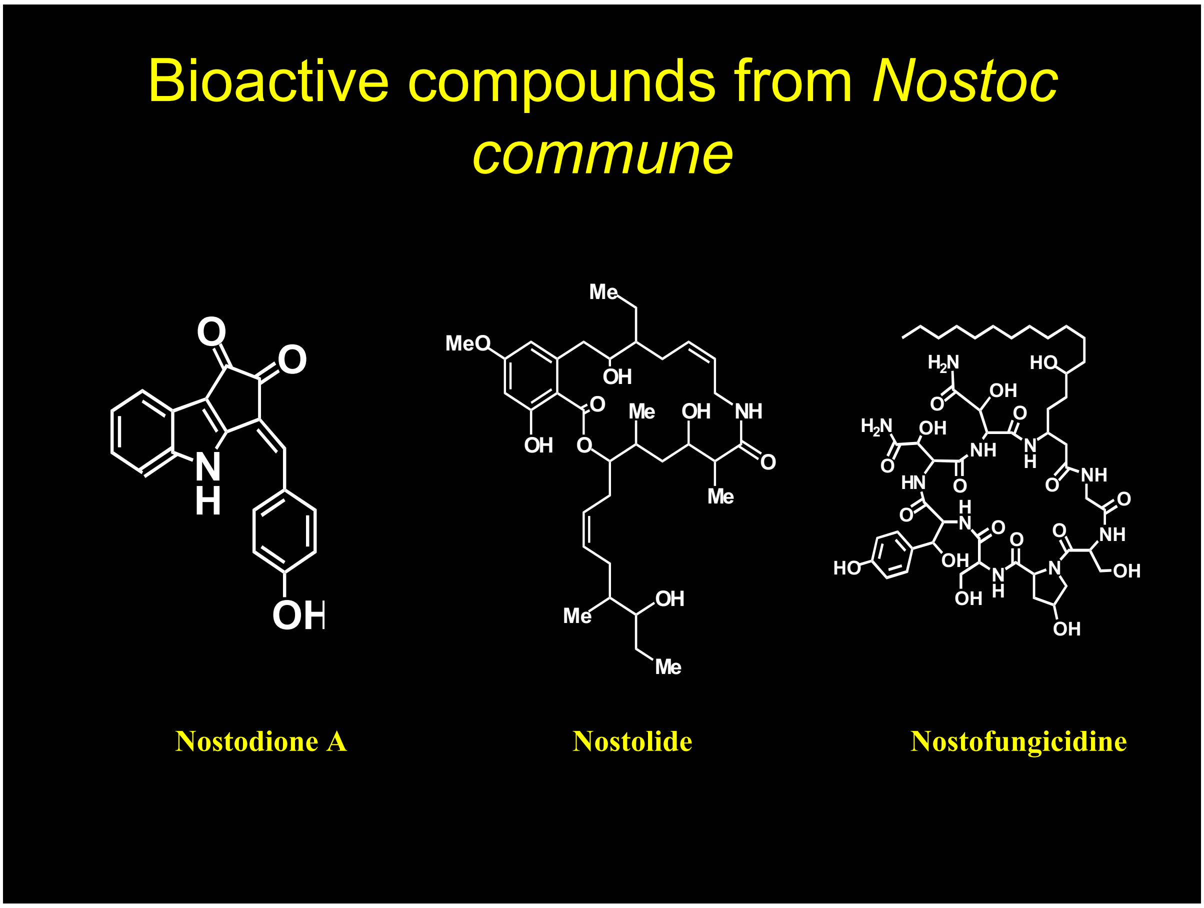
Oligosaccharides
(trehalose, sucrose)

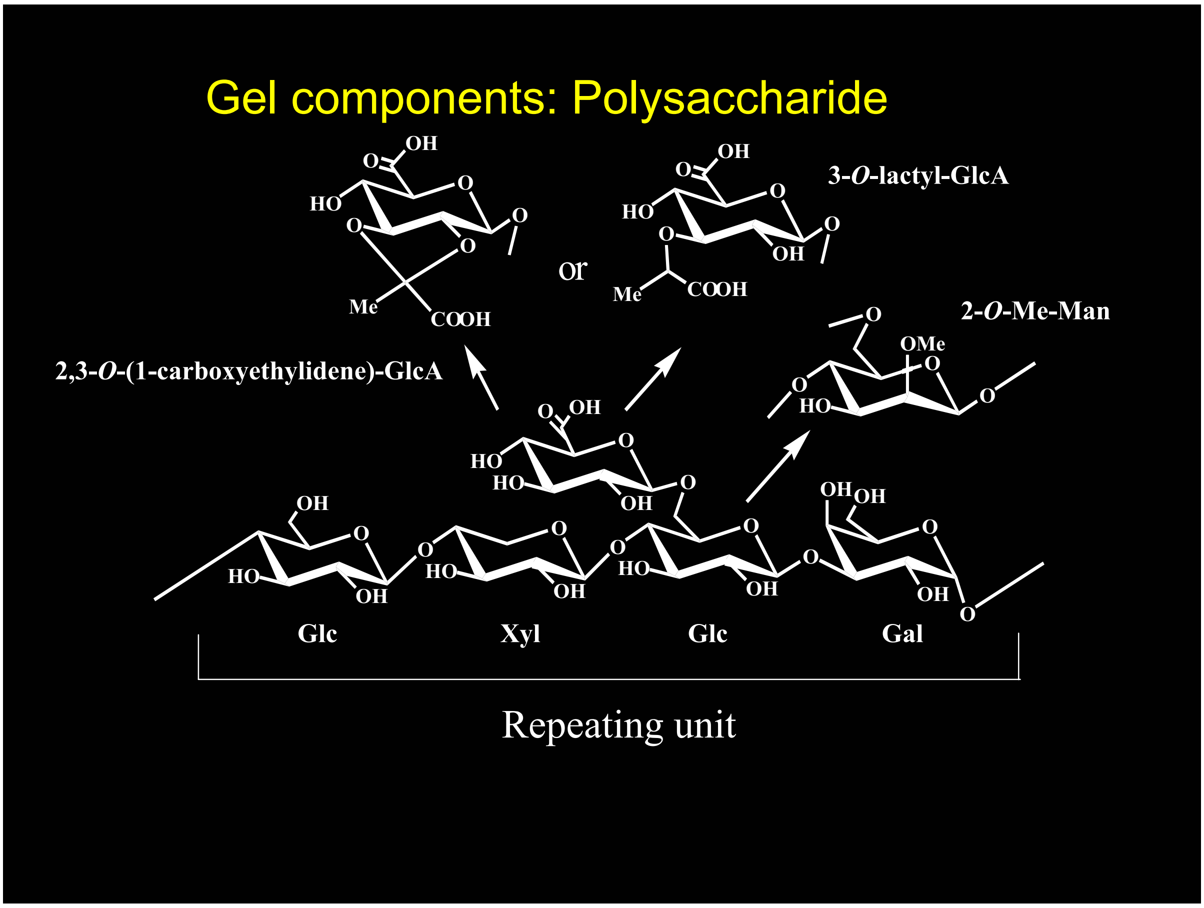


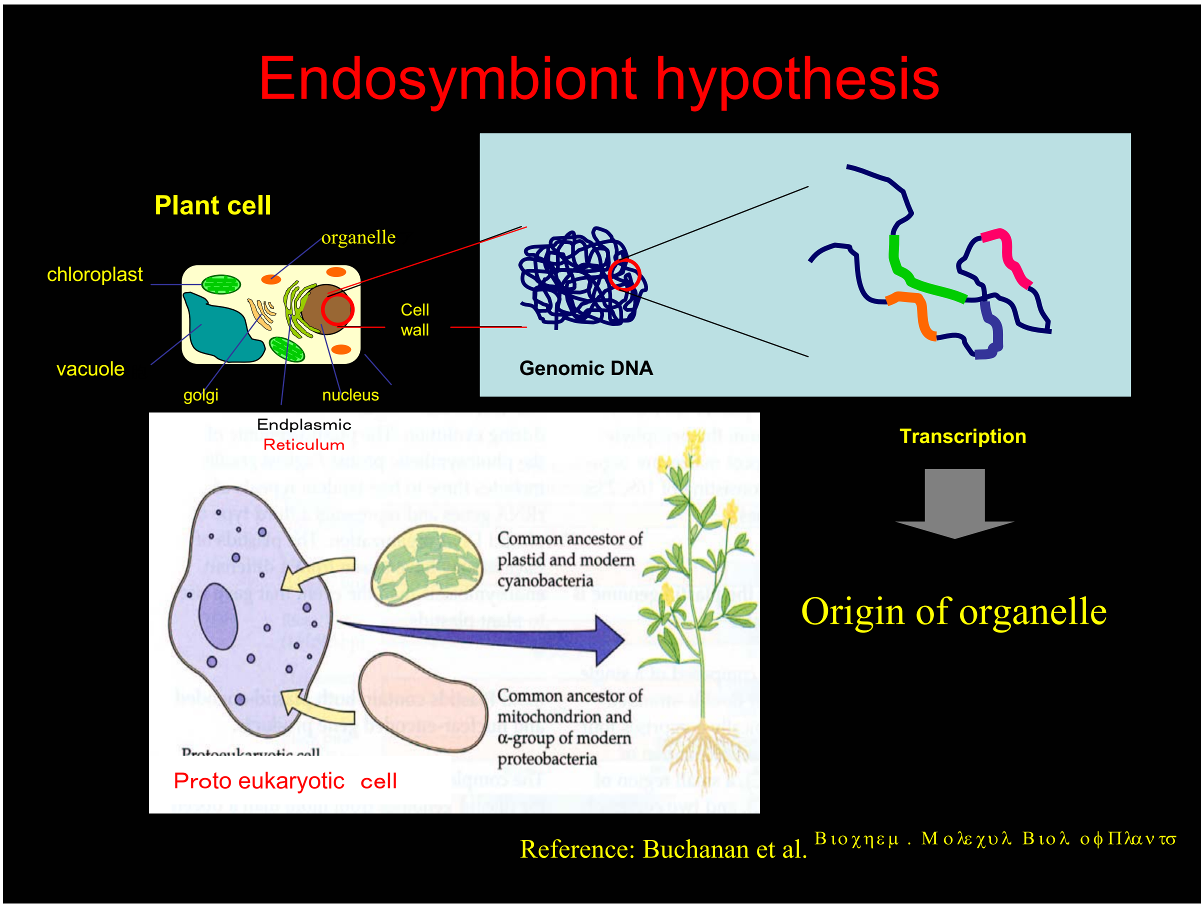
Mg, Ca, Si, P, S (EDX analysis

Superoxide dismutase

High molecular weight hetero polysaccharide
(> 60% of the dry weight of colonies)

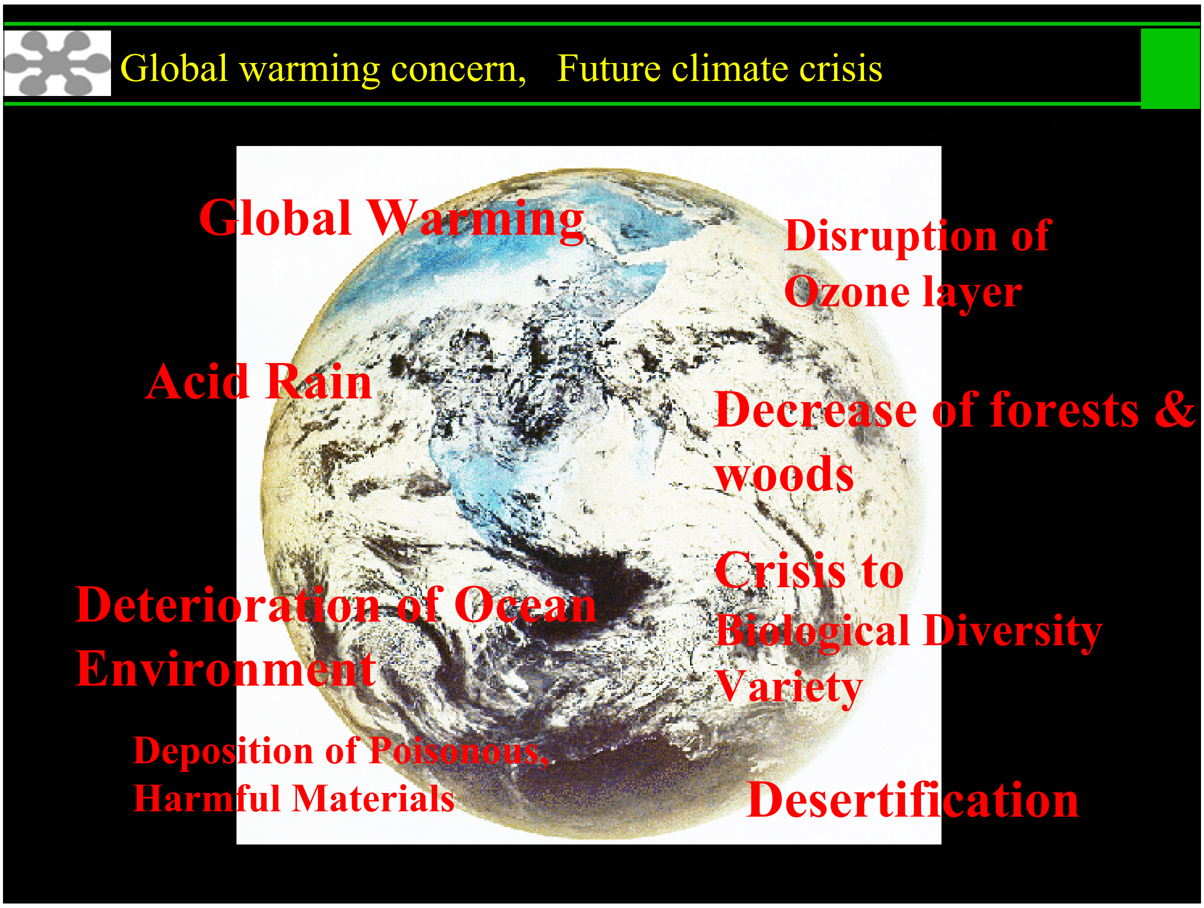

Bioactive compounds from *Nostoc commune*
Nostodione A
Nostolide
Nostofungicidine

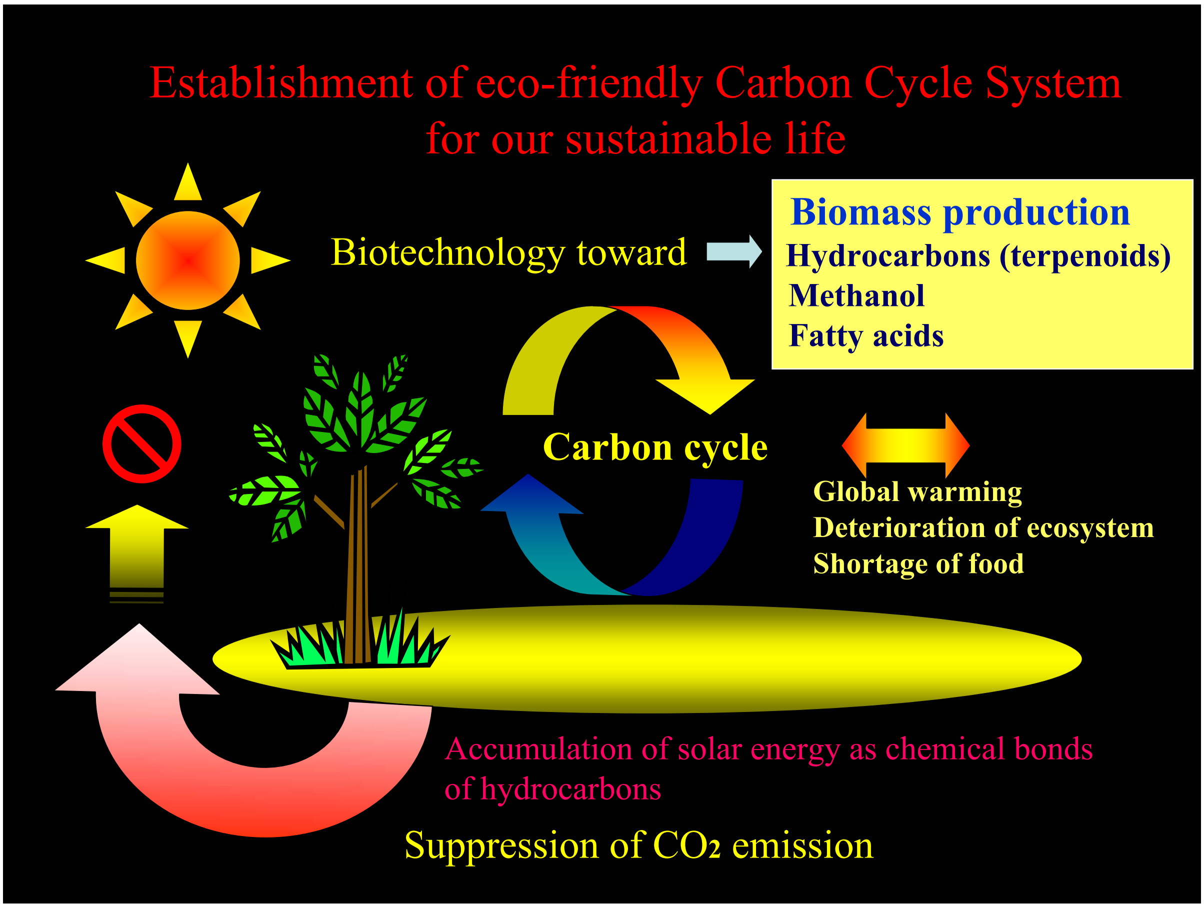

Gel components: Polysaccharide
2,3-*O*-(1-carboxyethylidene)-GlcA
or
3-*O*-lactyl-GlcA
2-*O*-Me-Man
Glc
Xyl
Glc
Gal
Repeating unit

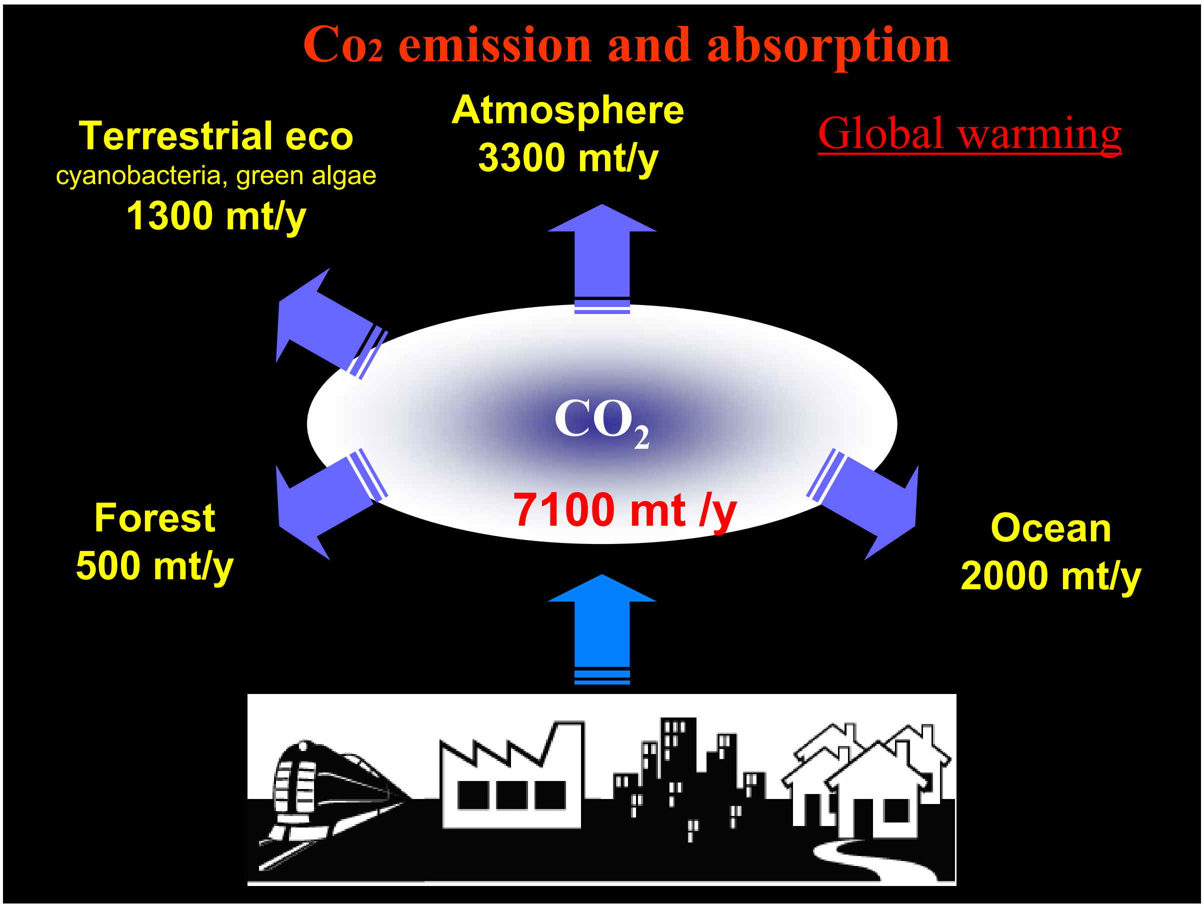


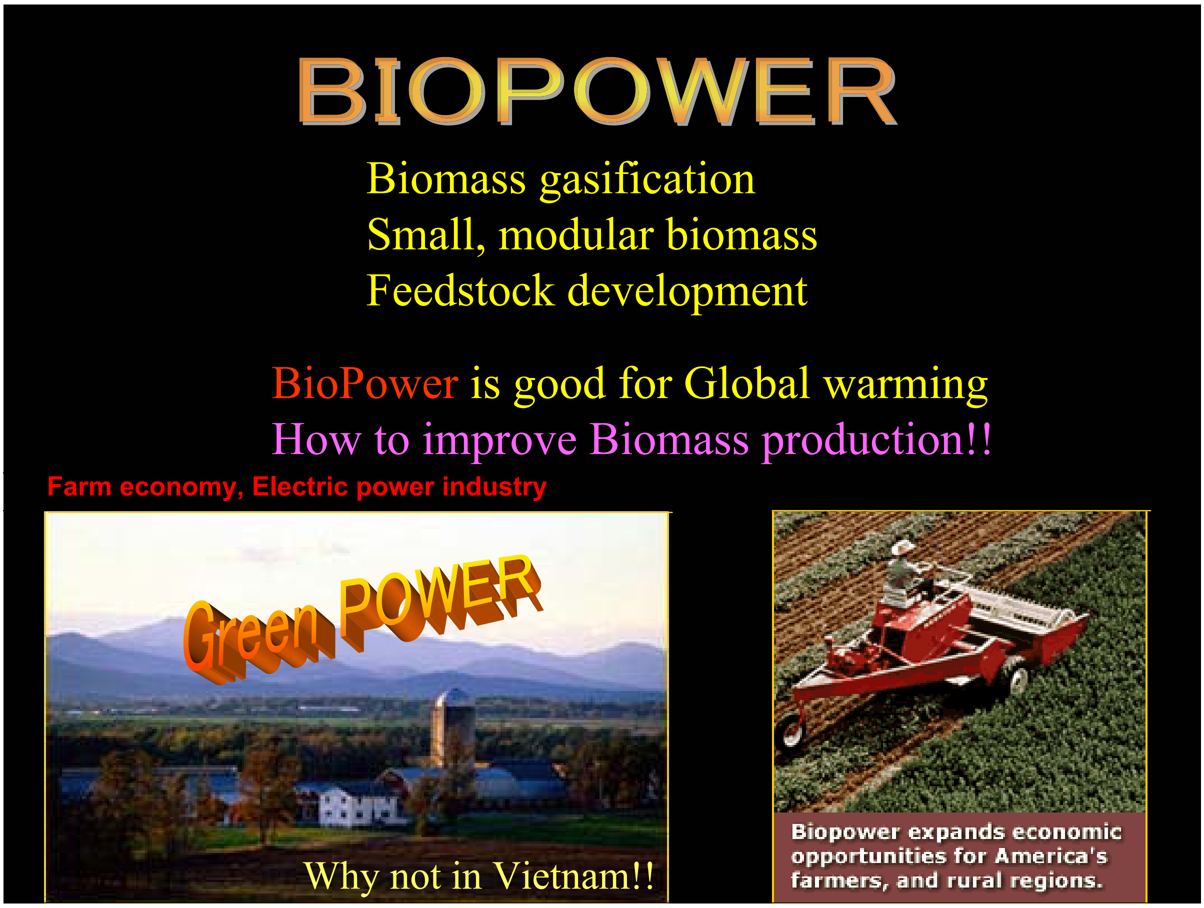
Endosymbiont hypothesis
Plant cell
organelle
chloroplast
Cell wall
vacuole
golgi
nucleus
Endplasmic
Reticulum
Genomic DNA
Transcription
Common ancestor of plastid and modern cyanobacteria
Common ancestor of mitochondrion and α-group of modern proteobacteria
Proto eukaryotic cell
Origin of organelle
Reference: Buchanan et al. Βιοχηεμ . Μολεχυλ Βιολ οφ Πλαντσ

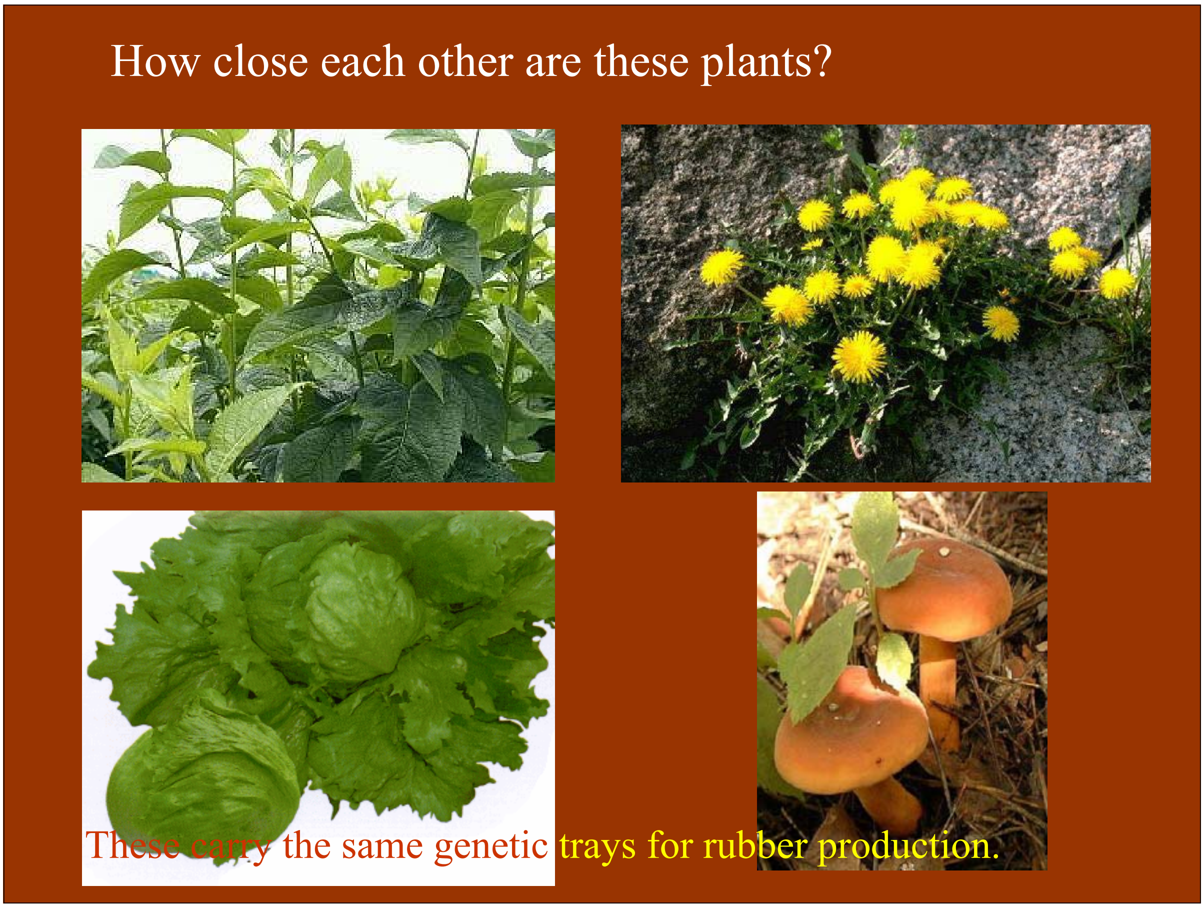
Prehistoric scene
（Archaeopteryx：始祖鳥）

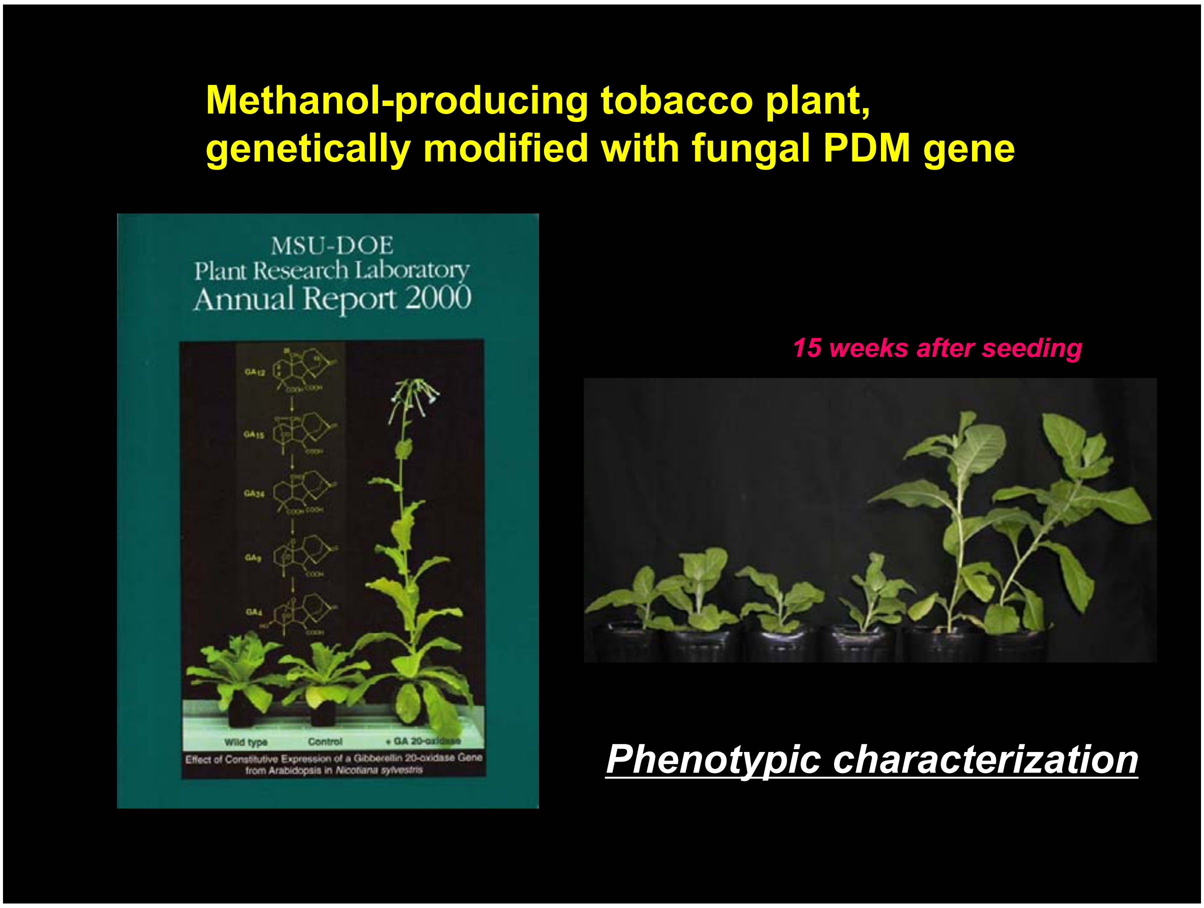

Global warming concern, Future climate crisis
Global Warming
Disruption of
Ozone layer
Acid Rain
Decrease of forests &
woods
Crisis to
Biological Diversity
Variety
Deterioration of Ocean
Environment
Deposition of Poisonous,
Harmful Materials
Desertification

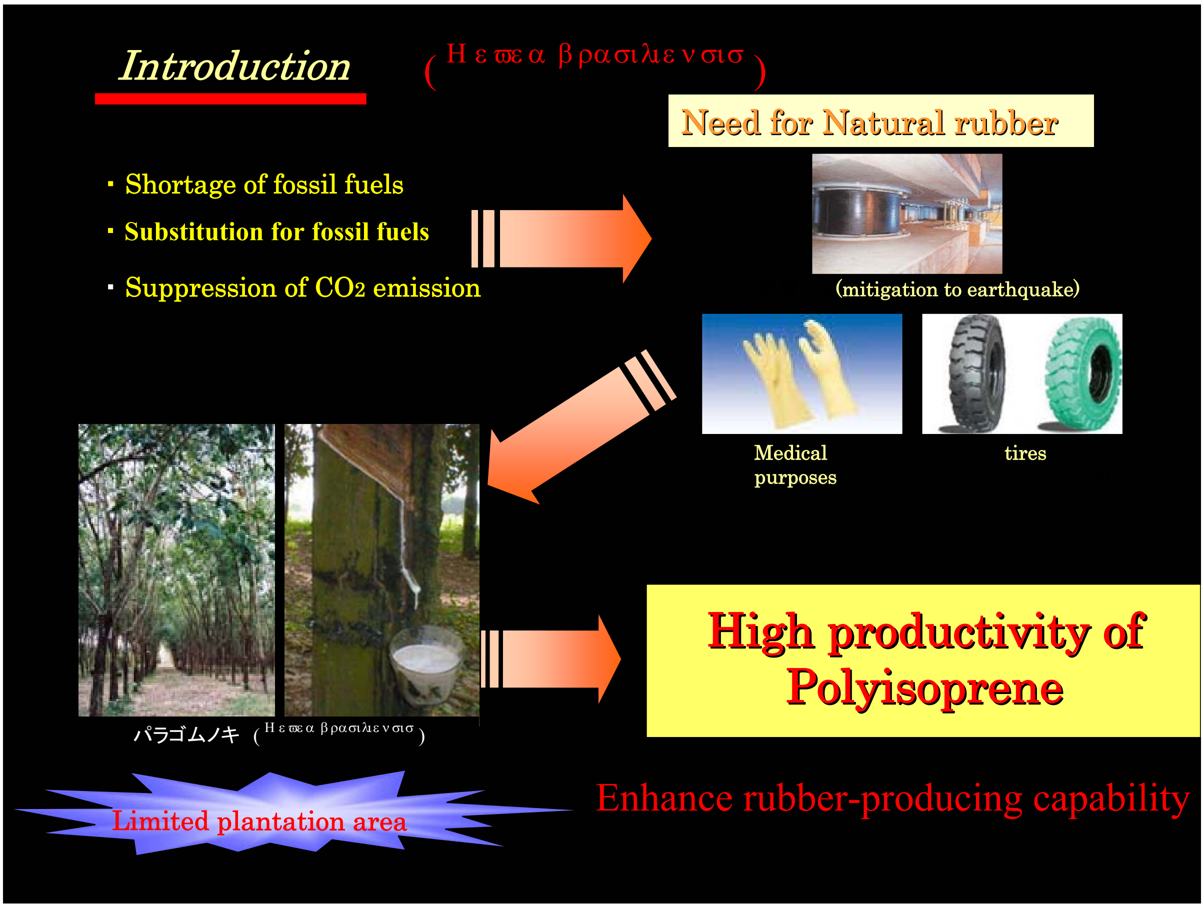

Establishment of eco-friendly Carbon Cycle System
for our sustainable life
Biotechnology toward
Biomass production
Hydrocarbons (terpenoids)
Methanol
Fatty acids
Carbon cycle
Global warming
Deterioration of ecosystem
Shortage of food
Accumulation of solar energy as chemical bonds
of hydrocarbons
Suppression of CO_2 emission

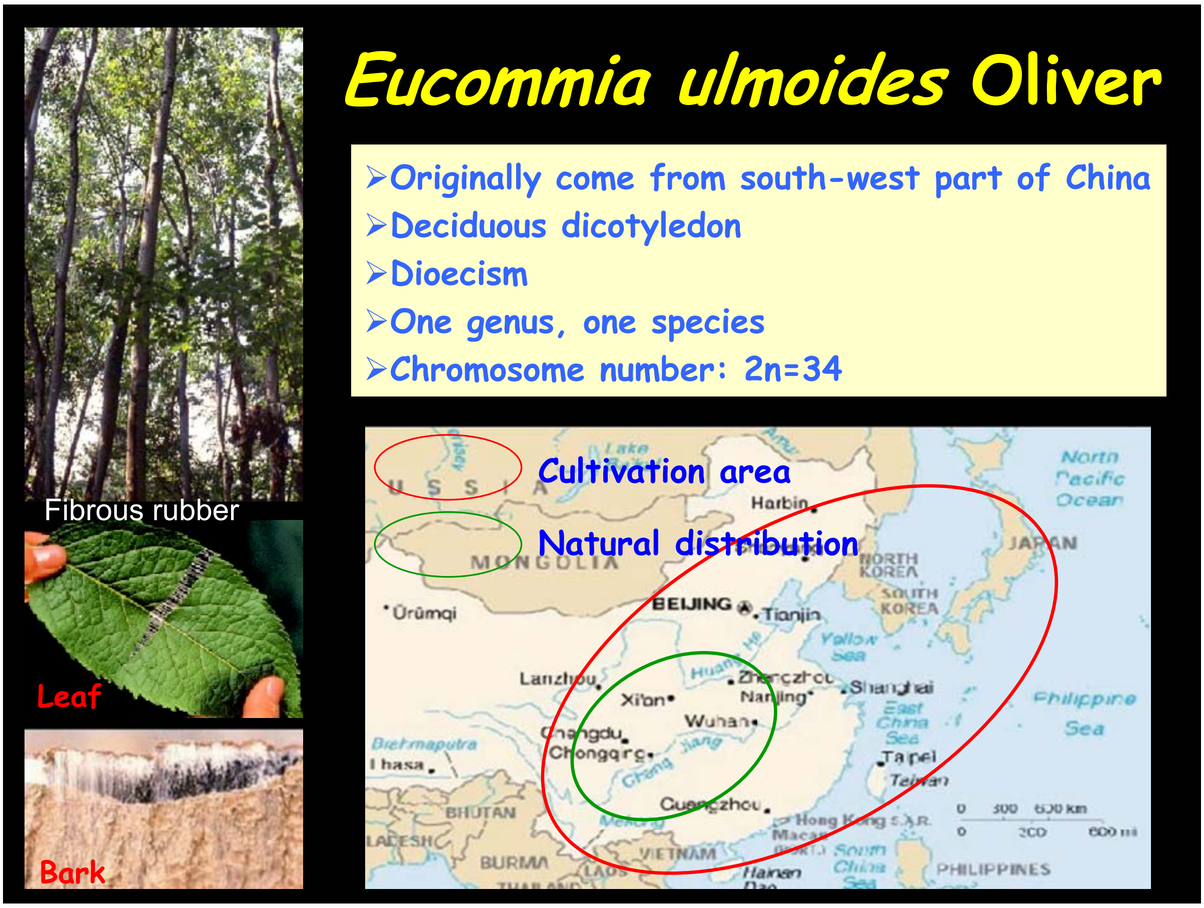

Co2 emission and absorption
Terrestrial eco
cyanobacteria, green algae
1300 mt/y
Atmosphere
3300 mt/y
Global warming
CO2
7100 mt /y
Forest
500 mt/y
Ocean
2000 mt/y


BIOPOWER
Biomass gasification
Small, modular biomass
Feedstock development
BioPower is good for Global warming
How to improve Biomass production!!
Farm economy, Electric power industry
Green POWER
Why not in Vietnam!!
Biopower expands economic opportunities for America's farmers, and rural regions.


How close each other are these plants?
These carry the same genetic trays for rubber production.

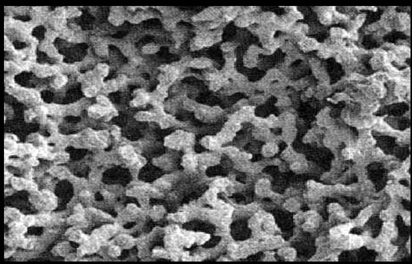

Methanol-producing tobacco plant,
genetically modified with fungal PDM gene
MSU-DOE
Plant Research Laboratory
Annual Report 2000
Wild type
Control
+ GA 20-oxidase
Effect of Constitutive Expression of a Gibberellin 20-oxidase Gene from Arabidopsis in Nicotiana sylvestris
15 weeks after seeding
Phenotypic characterization


Introduction
(Ηεϖεα βρασιλιενσισ)
Need for Natural rubber
Shortage of fossil fuels
Substitution for fossil fuels
Suppression of CO2 emission
(mitigation to earthquake)
Medical purposes
tires
パラゴムノキ (Ηεϖεα βρασιλιενσισ)
High productivity of Polyisoprene
Limited plantation area
Enhance rubber-producing capability


Eucommia ulmoides Oliver
Originally come from south-west part of China
Deciduous dicotyledon
Dioecism
One genus, one species
Chromosome number: 2n=34
Fibrous rubber
Leaf
Bark
Cultivation area
Natural distribution
MONGOLIA
Harbin
BEIJING
Tianjin
Ürümqi
Lanzhou
Xi'an
Nanjing
Shanghai
Wuhan
Chengdu
Chongqing
Guangzhou
Taipei
Taiwan
Lhasa
BHUTAN
BURMA
VIETNAM
LAOS
NORTH KOREA
SOUTH KOREA
JAPAN
Yellow Sea
East China Sea
South China Sea
Philippine Sea
North Pacific Ocean
PHILIPPINES

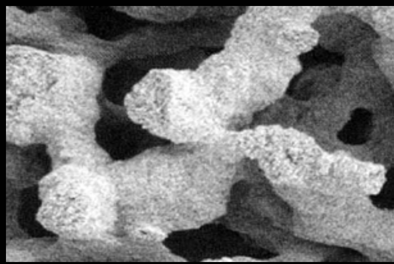
Monolithic silica column

macroporous



10 μm

mesoporous

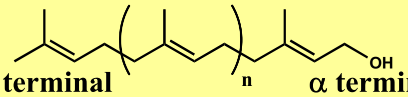


1 μm

Chromolith PerformanceRP-18e
(100 × 4.6mmI.D., Merck)

Chemical Structures of Natural Polyprenols

I. All-*trans*

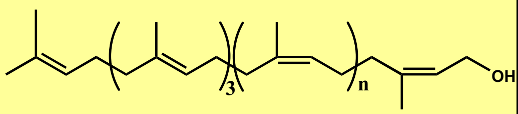


ω terminal α terminal

n = 7 Solanesol, n = 8 Spadicol

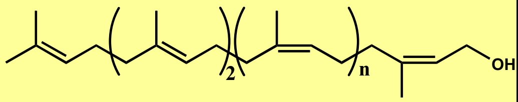
Poly-*trans* prenol

II. Tri-*trans*, Poly-*cis*



Ficaprenol type

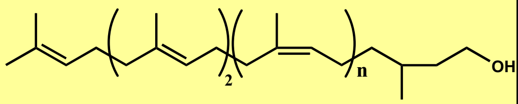
III. Di-*trans*, Poly-*cis*



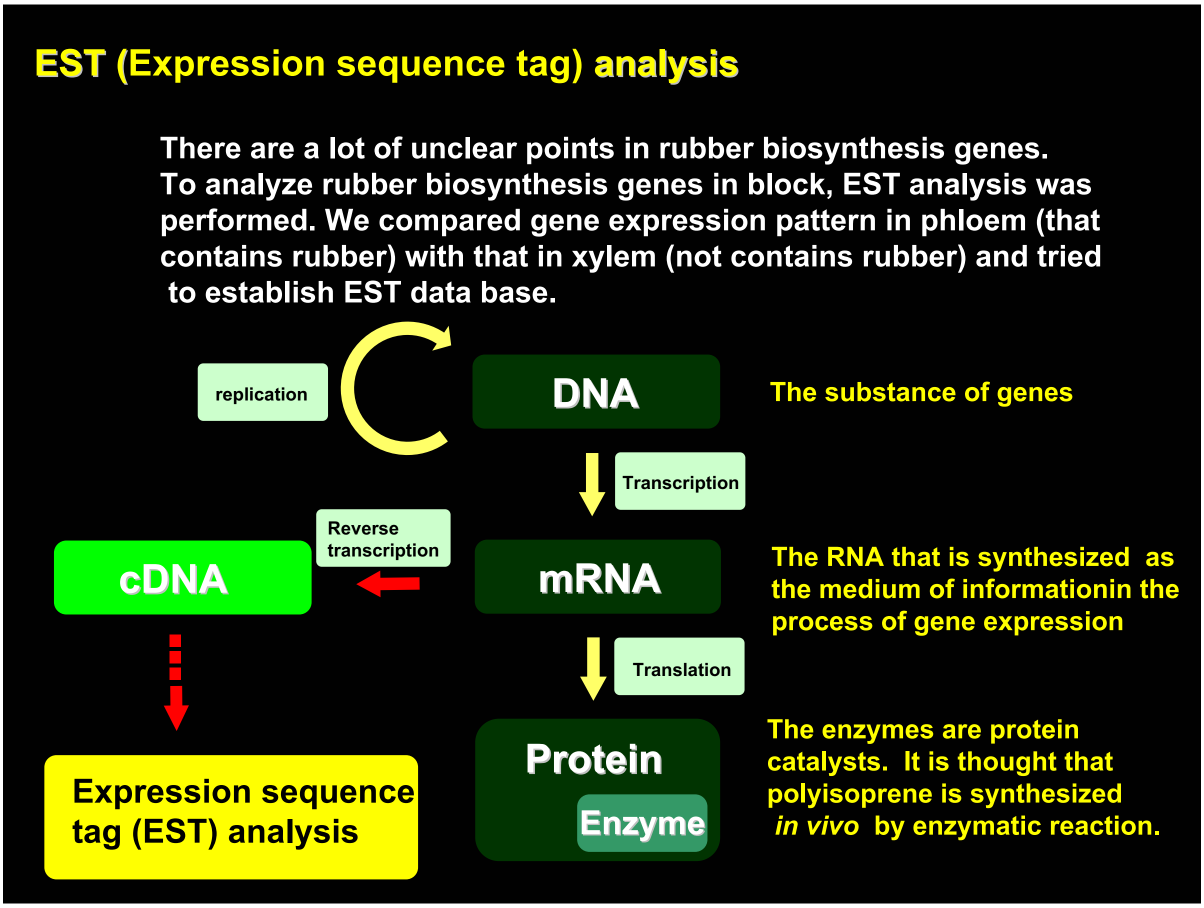
Bacteriaprenol type, Betulaprenol type

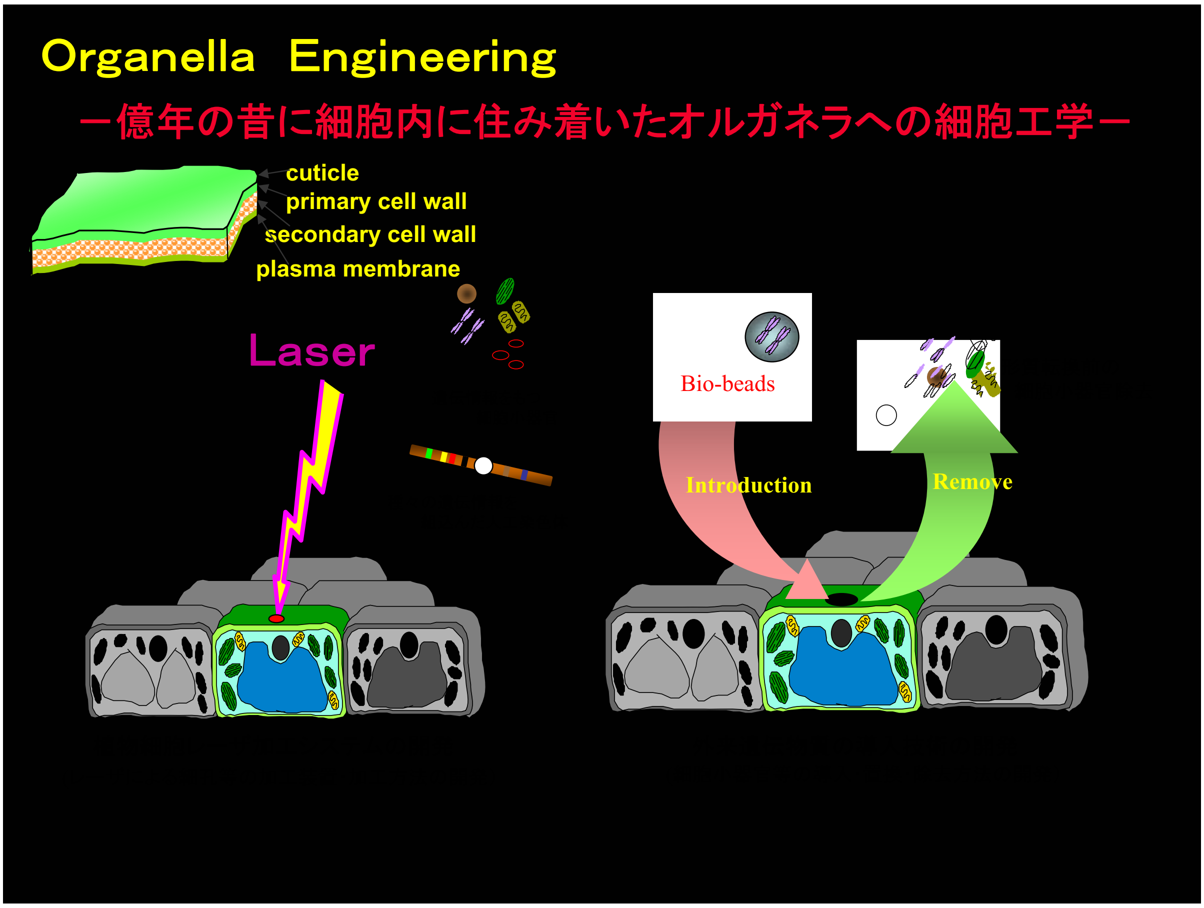
Poly-*cis* prenol

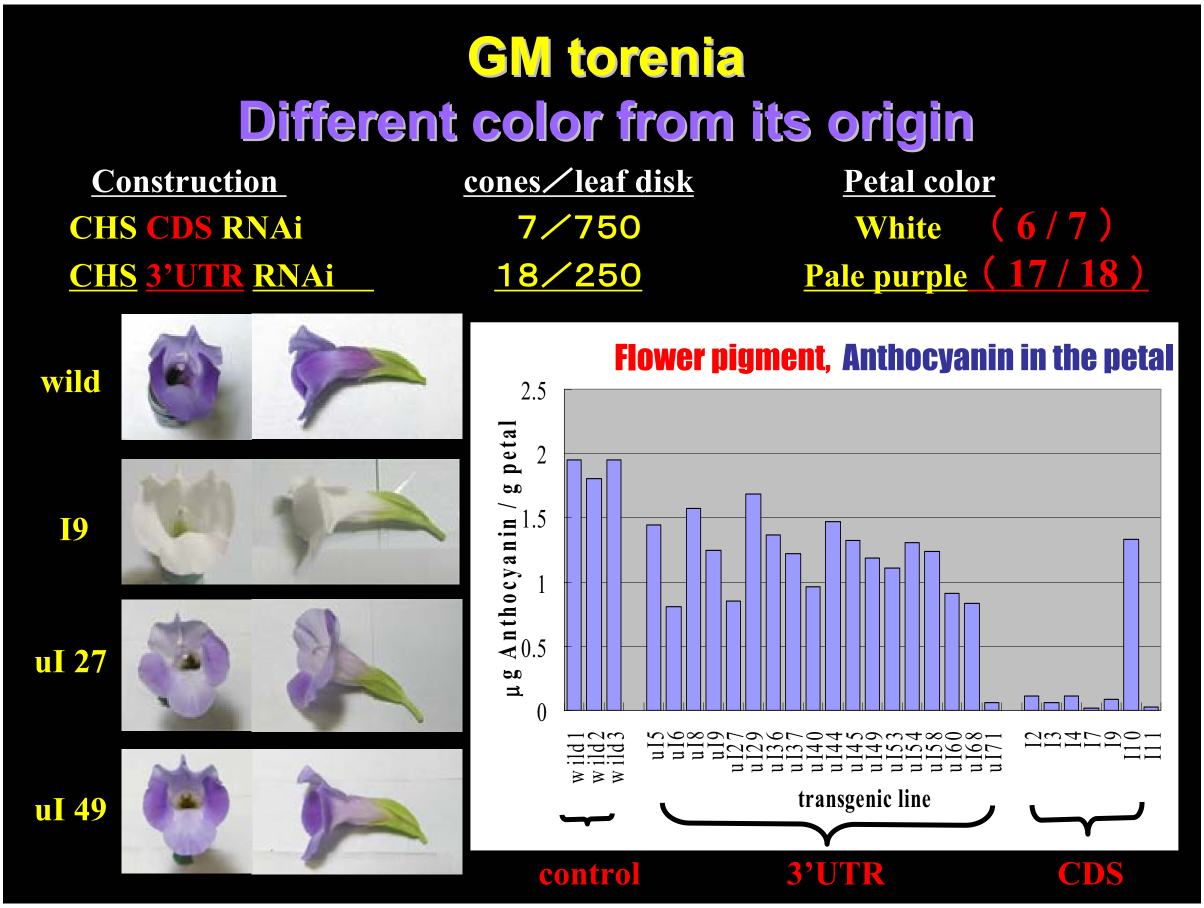
IV. Di-*trans*, Poly-*cis* (α-saturated)

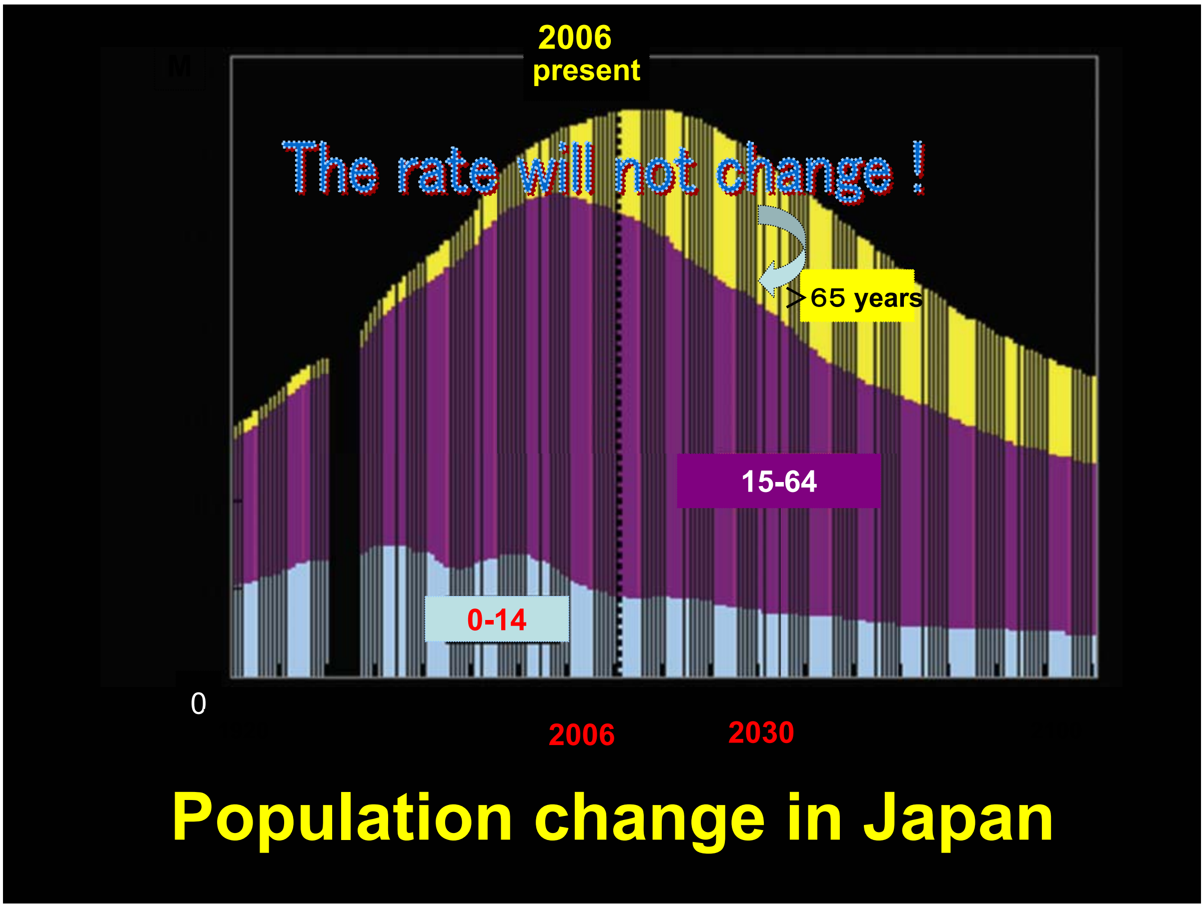


Dolichol type


EST (Expression sequence tag) analysis
There are a lot of unclear points in rubber biosynthesis genes.
To analyze rubber biosynthesis genes in block, EST analysis was performed. We compared gene expression pattern in phloem (that contains rubber) with that in xylem (not contains rubber) and tried to establish EST data base.
replication
DNA
The substance of genes
Transcription
Reverse transcription
cDNA
mRNA
The RNA that is synthesized as the medium of informationin the process of gene expression
Translation
Protein
Enzyme
The enzymes are protein catalysts. It is thought that polyisoprene is synthesized *in vivo* by enzymatic reaction.
Expression sequence tag (EST) analysis


Organella Engineering
－億年の昔に細胞内に住み着いたオルガネラへの細胞工学－
cuticle
primary cell wall
secondary cell wall
plasma membrane
Laser
Bio-beads
Introduction
Remove


GM torenia
Different color from its origin
Construction
CHS CDS RNAi
CHS 3'UTR RNAi
cones／leaf disk
7／750
18／250
Petal color
White （6 / 7）
Pale purple（17 / 18）
wild
I9
uI 27
uI 49
Flower pigment, Anthocyanin in the petal
μg Anthocyanin / g petal
2.5
2
1.5
1
0.5
0
wild1
wild2
wild3
transgenic line
control
3'UTR
CDS


2006
present
The rate will not change !
>65 years
15-64
0-14
0
2006
2030
Population change in Japan

Leave your drugs in the chemist's pot if you can heal the patient with food!
Let food be your medicine!

BC460-360 the Father of Medicine

Hippocrates said :
Food is medicine !
Old medicine and food have the same origin !

Greek visonary

Investigation of new drugs

↓ The same strategy !

Interest New food

病気の発症の誘起 進行の助長

栄養源： 同化・異化・蓄積・排出

Common methodology and techniques

Food = Organic compounds

Fused technologies

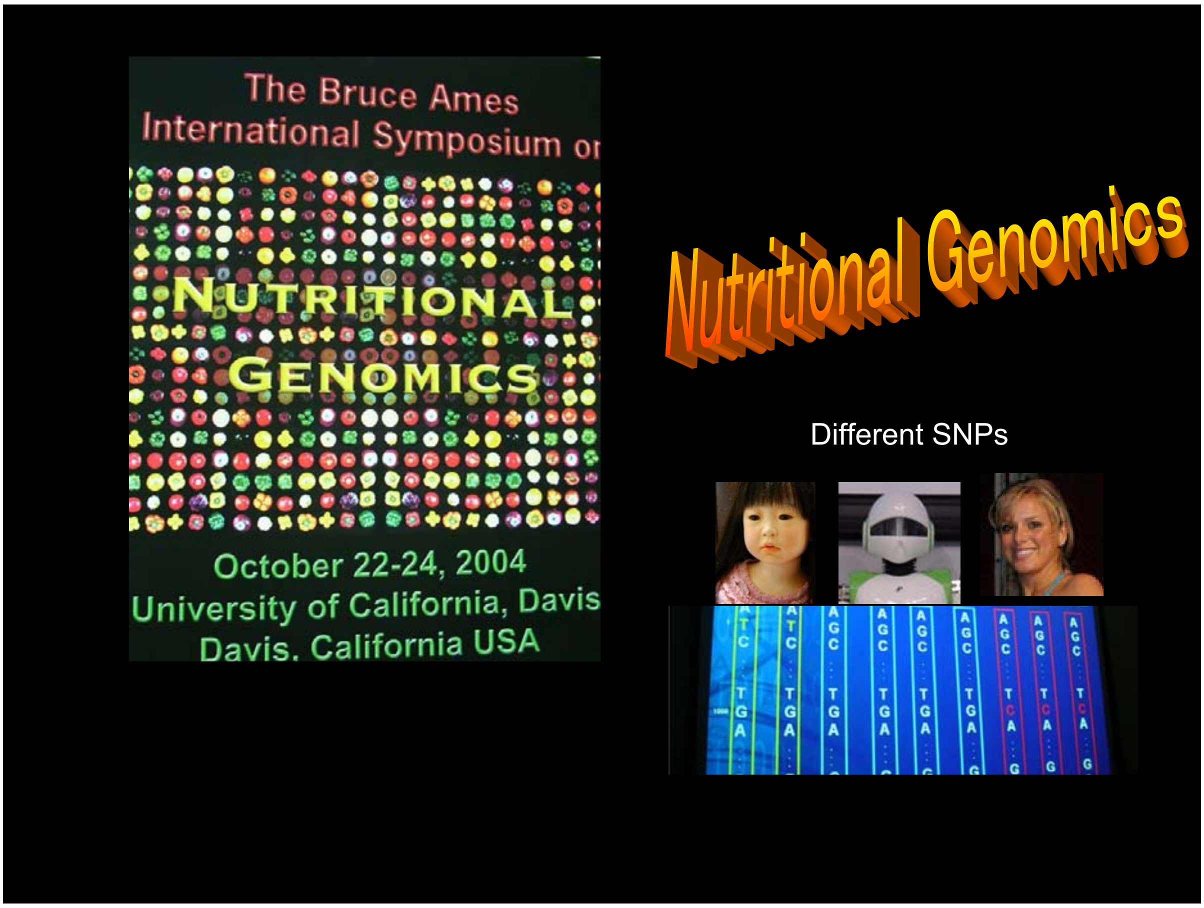
SNPs analysis
Transcriptomics describes this process in a genome-wide range

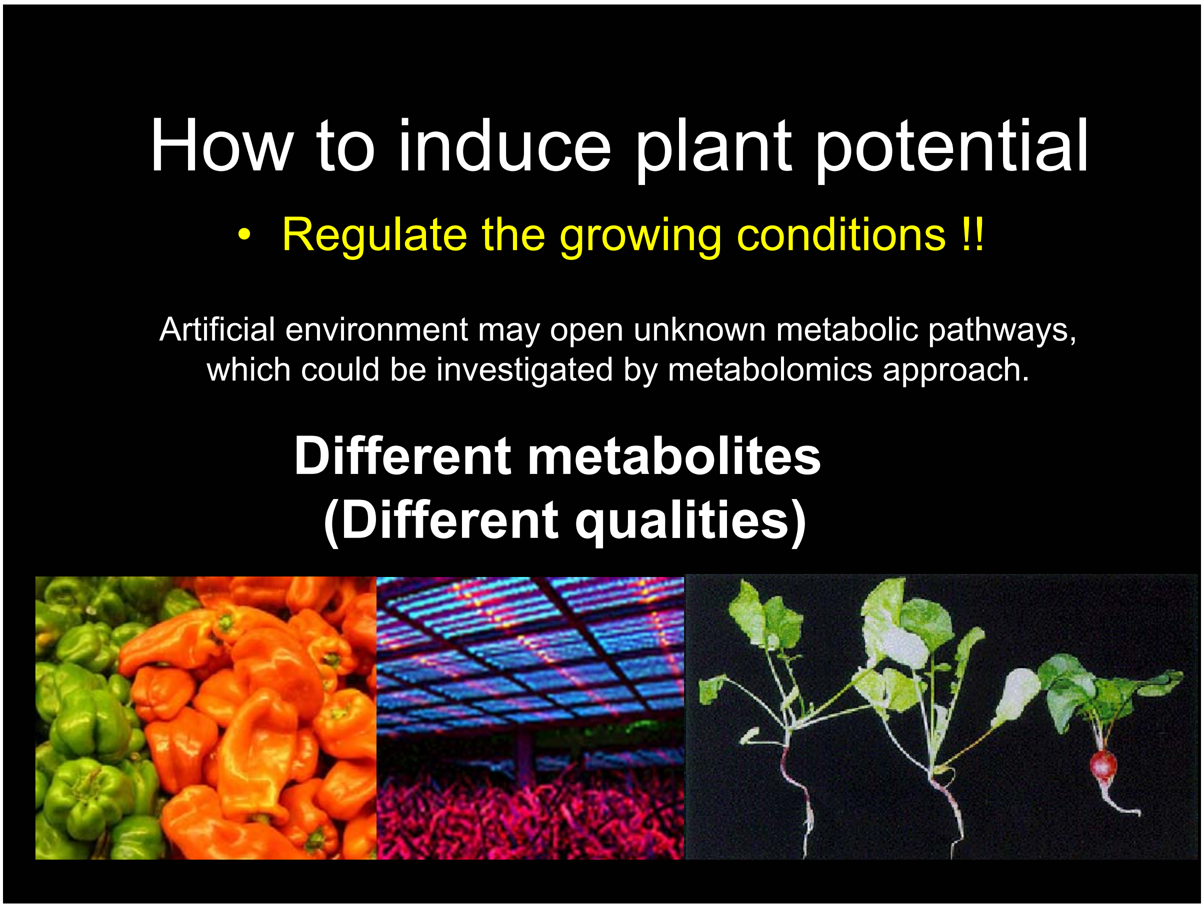
Chemicals → Food

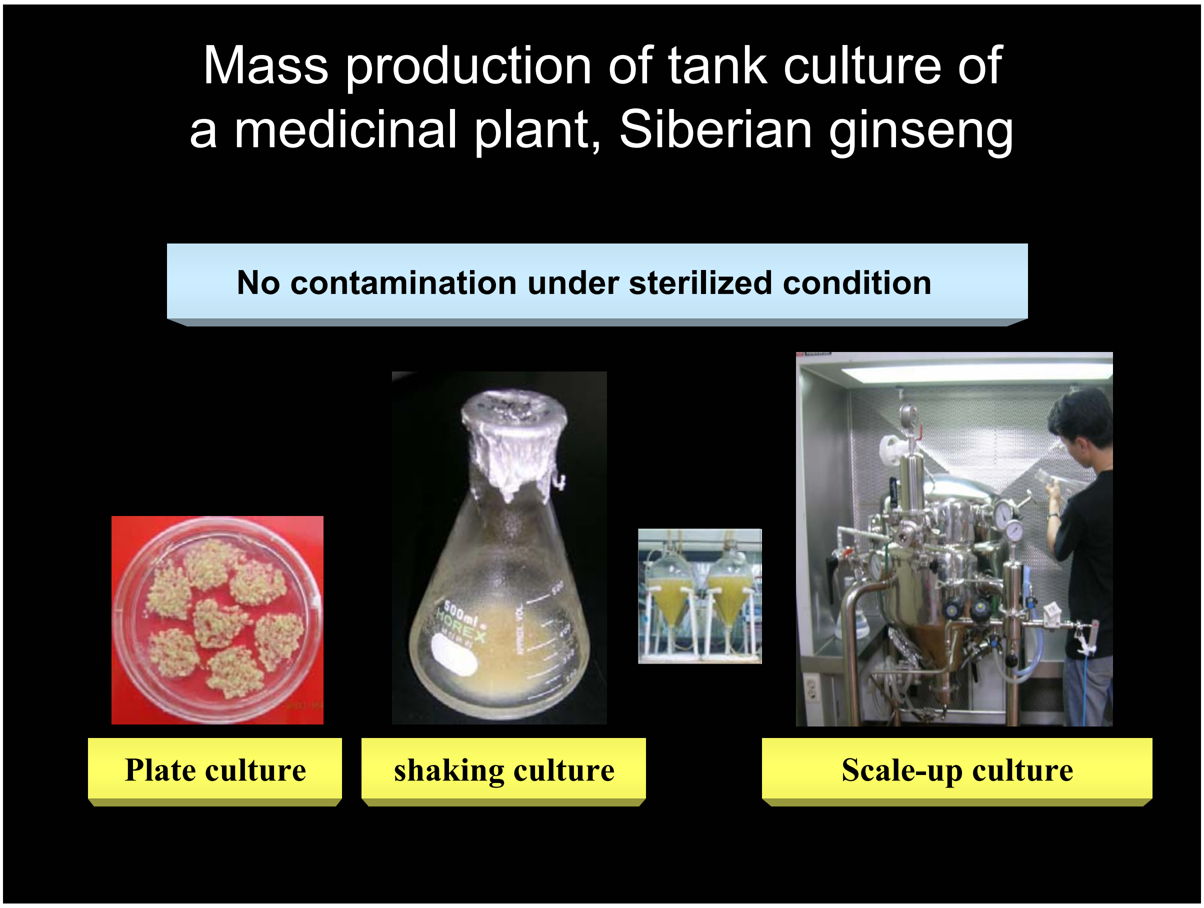
Proteomics
Metabolomics

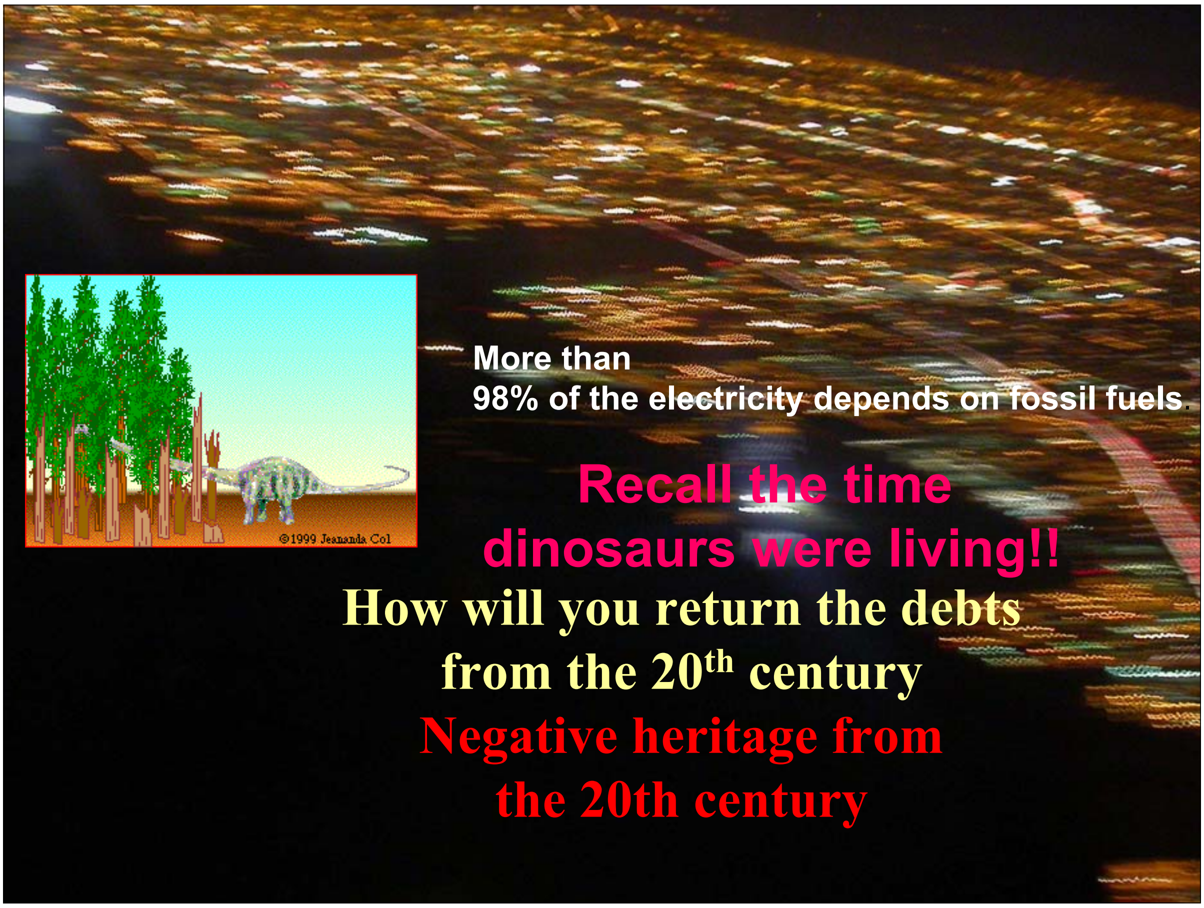
Phytochemicals

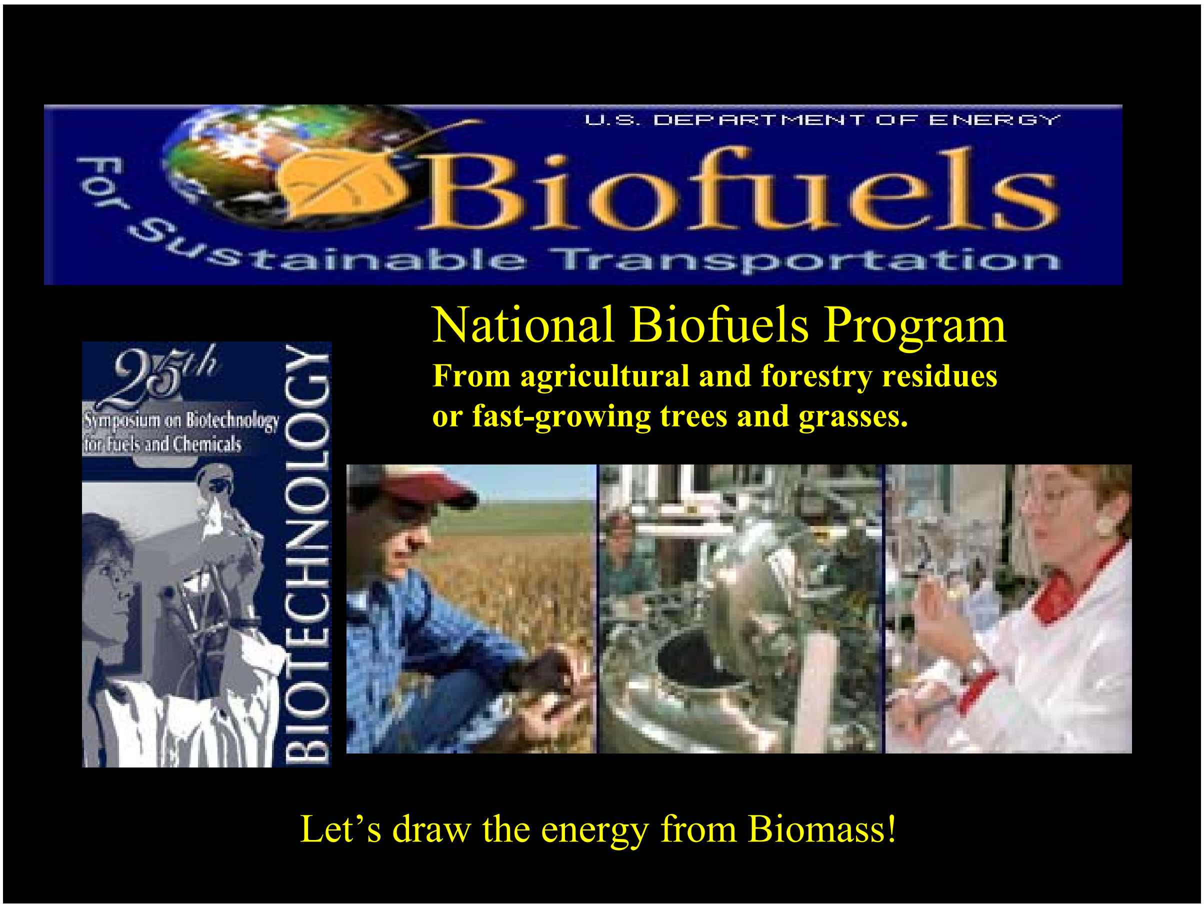
Bioinformatics
Systems biological techniques


The Bruce Ames
International Symposium
NUTRITIONAL
GENOMICS
October 22-24, 2004
University of California, Davis
Davis, California USA
Nutritional Genomics
Different SNPs


How to induce plant potential
• Regulate the growing conditions !!
Artificial environment may open unknown metabolic pathways, which could be investigated by metabolomics approach.
Different metabolites
(Different qualities)


Mass production of tank culture of
a medicinal plant, Siberian ginseng
No contamination under sterilized condition
Plate culture
shaking culture
Scale-up culture


More than
98% of the electricity depends on fossil fuels
Recall the time
dinosaurs were living!!
How will you return the debts
from the 20th century
Negative heritage from
the 20th century
©1999 Jeananda Col


U.S. DEPARTMENT OF ENERGY
Biofuels
For Sustainable Transportation
National Biofuels Program
From agricultural and forestry residues
or fast-growing trees and grasses.
25th
Symposium on Biotechnology
for Fuels and Chemicals
BIOTECHNOLOGY
Let's draw the energy from Biomass!


Biotechnology made it !!
The dream came true!

BIOMASS-ASIA PARTNERSHIP

Shinya Yokoyama
Department of Biological and Environmental Engineering
Graduate School of Agricultural and Life Sciences
The University of Tokyo
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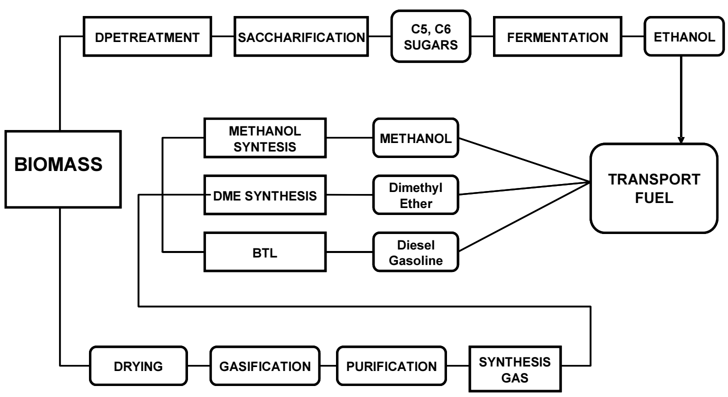
E-mail address: syokoyama@bme.en.a.u-tokyo.ac.jp

In Asian countries, economic growth has been remarkably increasing and at the same time the energy consumption, particularly oil consumption, has been expanding, leading to the burden to the global environment. Such trend is expected to continue. One of the options to cope with this situation is to make use of biomass in order to produce alternative energy from agricultural waste, forestry wastes and energy crops. In this lecture, international infrastructure, that is, Biomass- Asia Partnership, will be proposed to make this scenario practical.

In Asian region, the production and consumption of coal and natural gas have been almost balanced for nearly twenty years. However, the consumption of petroleum has exceeded the production in this region. For example, China, which produces petroleum, has been importing petroleum mainly from Middle East since 1993. Indonesia, Vietnam, and Malaysia which all produce petroleum has been importing petroleum like China. According to the statistics, the production of petroleum in Asian region was 349 million TOE, while the consumption was 1,004 million TOE, consequently the balance, 655 million TOE, was imported in 2003. The net import of petroleum is expected to increase year by year due to the economic growth together with rapid motorization in Asian region particularly in China and India. The petroleum price has been increasing up to 70US dollars per barrel and this trend may continue and the struggle for petroleum will become more serious. The mass consumption of petroleum as well as coal and natural gas threatens the global environment, that is, global warming by the carbon dioxide.

To cope with petroleum shortage and global warming is to produce alternative liquid fuel form biomass. If the liquid fuel can be produced from biomass, such as, agricultural and forestry wastes, it greatly contribute the global energy and environmental issues. Because biomass is renewable and carbon neutral. As can be seen in Figure, there are some routes to produce liquid fuel such as ethanol, methanol, DME(dimethyl ether), gasoline and diesel alternatives through biological and thermochemical processes.

If we collaborate with Asian countries to establish consortium for the production petroleum alternative liquid fuels from biomass, both sides can enjoy benefits. The dependency on petroleum can be reduced, carbon dioxide emission can be suppressed, primary industries can be promoted by the activation of local economy and job acquisition, economic profits by emission trading and CDM can be obtained. In future, energy crops or energy plantation is supposed for larger scale energy production system. To make such concept realized, Biomass-Asia Partnership should be established.



Liquid Fuel Production Processes from Biomass

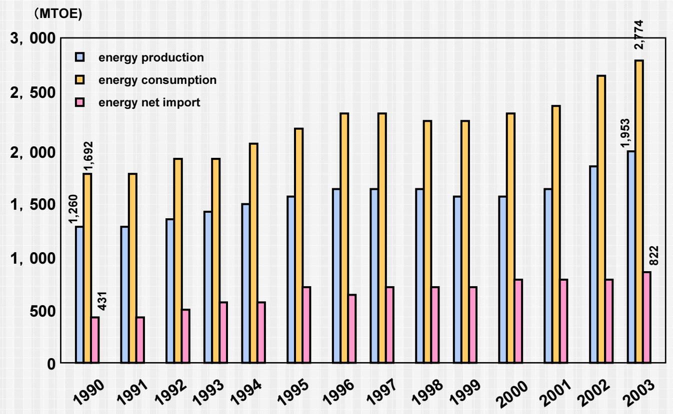
The Workshop on "Susutainable Societies and Industry Trans-formation with Zero Emission Initiatives"
November 6 and 7, 2006

BIOMASS-ASIA PARTNERSHIP

Shinya Yokoyama

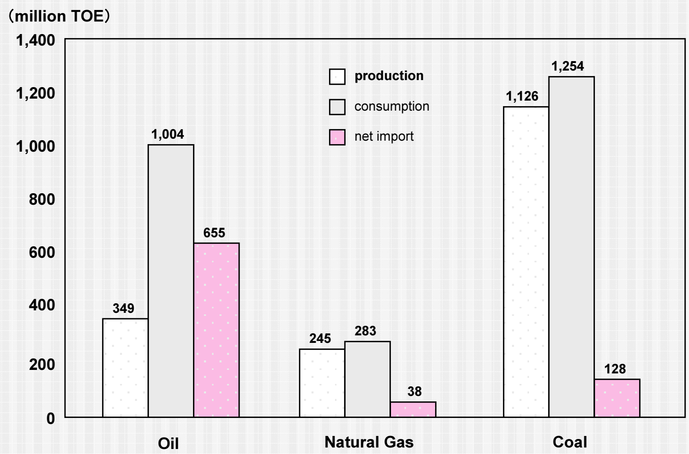
The University of Tokyo

PRIMARY ENERGY SUPPLY AND DEMAND IN ASIA



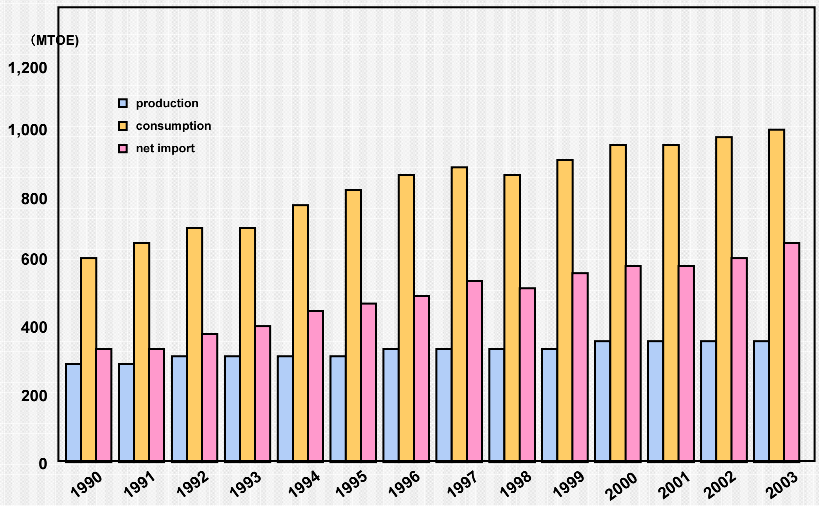
Cited from: Asia Energy Partnership, ed.
Yasuo Tanabe, Energy Forum (2004)

SUPPLY AND DEMAND BALANCE OF OIL, NATURAL GAS, AND COAL (2003)



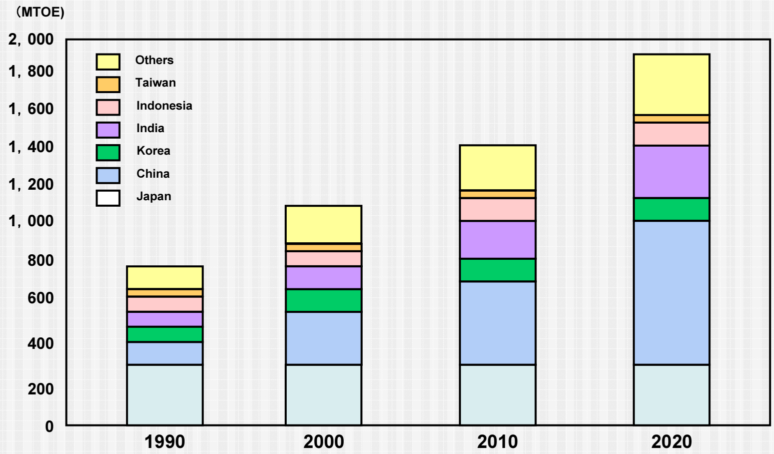
Cited from: Asia Energy Partnership, ed.
Yasuo Tanabe, Energy Forum (2004)

OIL SUPPLY AND DEMAND IN ASIA



Cited from: Asia Energy Partnership, ed.
Yasuo Tanabe, Energy Forum (2004)

PROSPECT OF OIL DEMAND IN ASIA



Cited from: Asia Energy Partnership, ed.
Yasuo Tanabe, Energy Forum (2004)

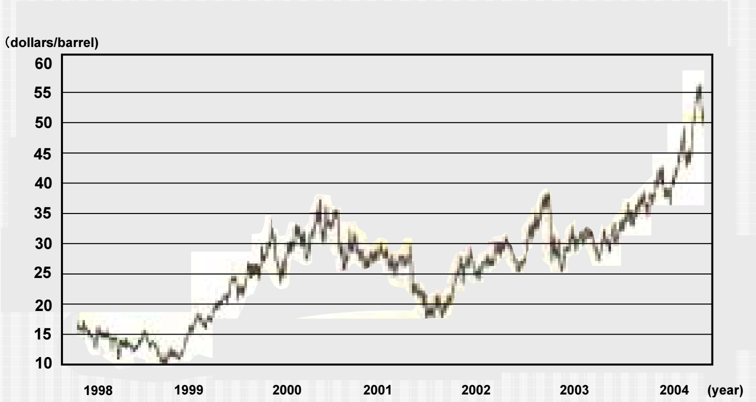
Prospect of Carbon Dioxide Emissions in China (BAU case)

	China		International level in 2000			
	2000	2030	USA	Japan	OECD	world
Carbon dioxide emissions (million ton - C)	900	2,575	1,577	325	3,463	6,407
CO_2 emission per capita (t – C /person)	0.71	1.73	5.61	2.58	3.07	1.06
2030- Chinese level / 2000-international level			30.9%	67.2%	56.5%	163.5%

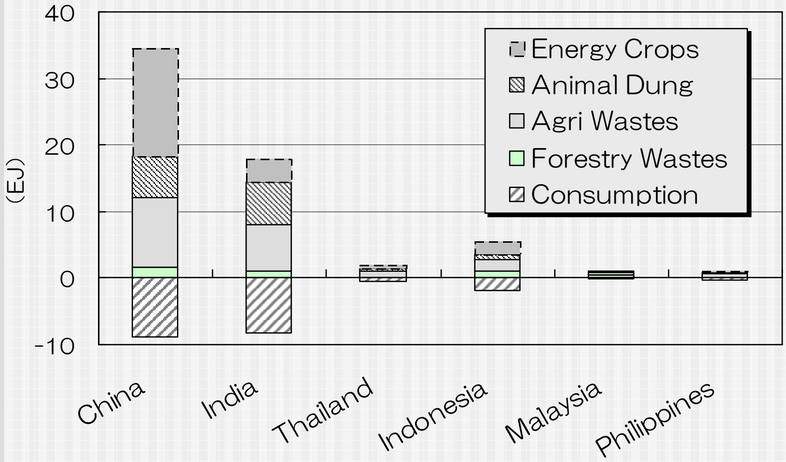
① In 2014, emission per capita in China will reach a world average level in 1990

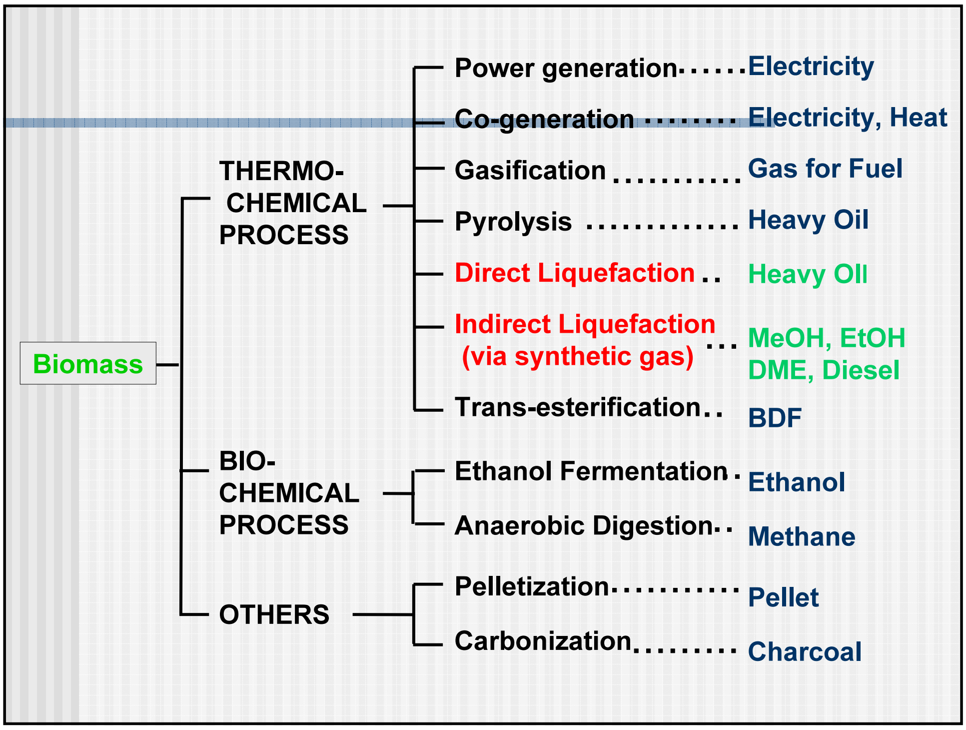
②Chinese government declared to suppress CO2 emission by 10th five year plan and organized CDM – related institution

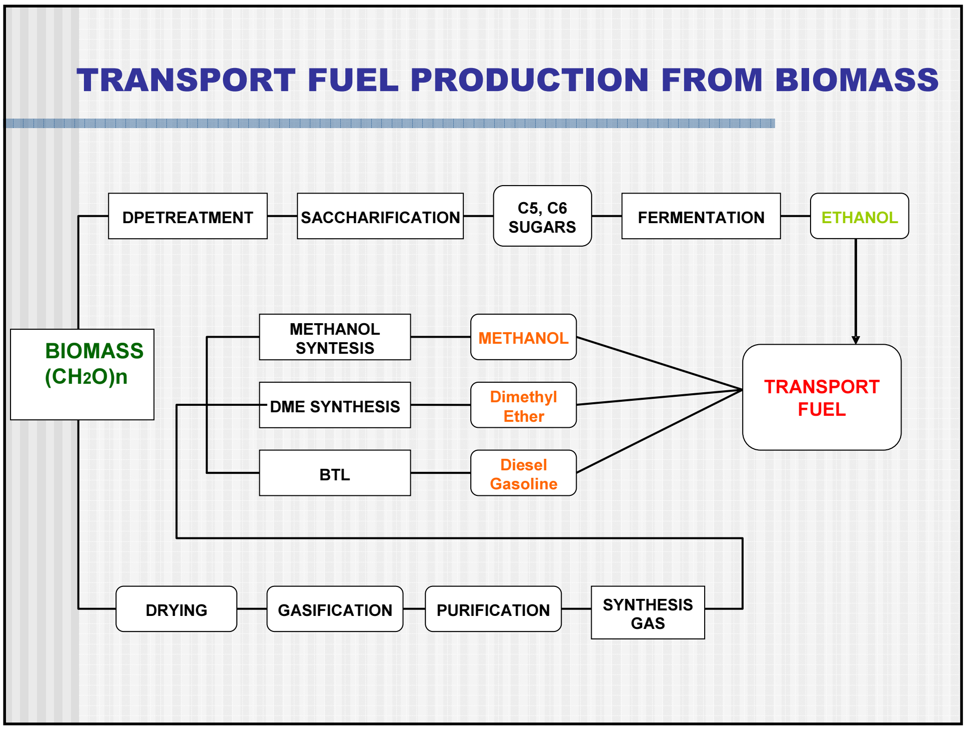
WTI CRUDE OIL PRICE



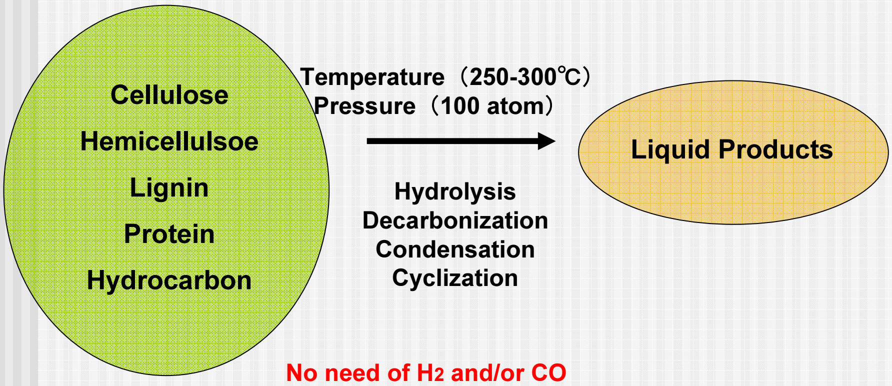
BIOMASS POTENTIAL IN ASIA




Biomass
THERMO-CHEMICAL PROCESS
Power generation ...... Electricity
Co-generation .... Electricity, Heat
Gasification .... Gas for Fuel
Pyrolysis .... Heavy Oil
Direct Liquefaction .. Heavy OIl
Indirect Liquefaction (via synthetic gas) ... MeOH, EtOH DME, Diesel
Trans-esterification .. BDF
BIO-CHEMICAL PROCESS
Ethanol Fermentation . Ethanol
Anaerobic Digestion .. Methane
OTHERS
Pelletization .... Pellet
Carbonization .... Charcoal


TRANSPORT FUEL PRODUCTION FROM BIOMASS
BIOMASS (CH2O)n
DPETREATMENT
SACCHARIFICATION
C5, C6 SUGARS
FERMENTATION
ETHANOL
METHANOL SYNTESIS
METHANOL
DME SYNTHESIS
Dimethyl Ether
BTL
Diesel Gasoline
TRANSPORT FUEL
DRYING
GASIFICATION
PURIFICATION
SYNTHESIS GAS

LIQUEFACTION



No need of H_2 and/or CO

No need of drying

Clean fuel

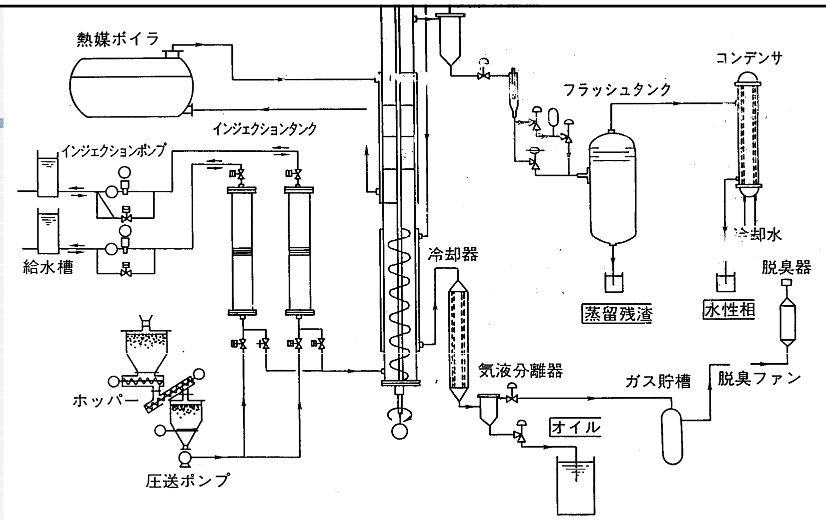
OPTIMUM CONDITIONS FOR LIQUEFACTION

	Temperature	Pressure	Holding time	Catalyst
Optimum condition	300℃	100kg/㎠	60～120 min	No need
Remarks	**Reaction starts over 220 ℃. Oil yield decreases over 350℃.**	**Oil yield does not change between 80 ～180 kg/㎠.**	The longer holding time diminishes the BOD of aq. phase.	There is no need of catalyst add-tion.

SEWAGE SLUDGE TREATMENT FACILITY

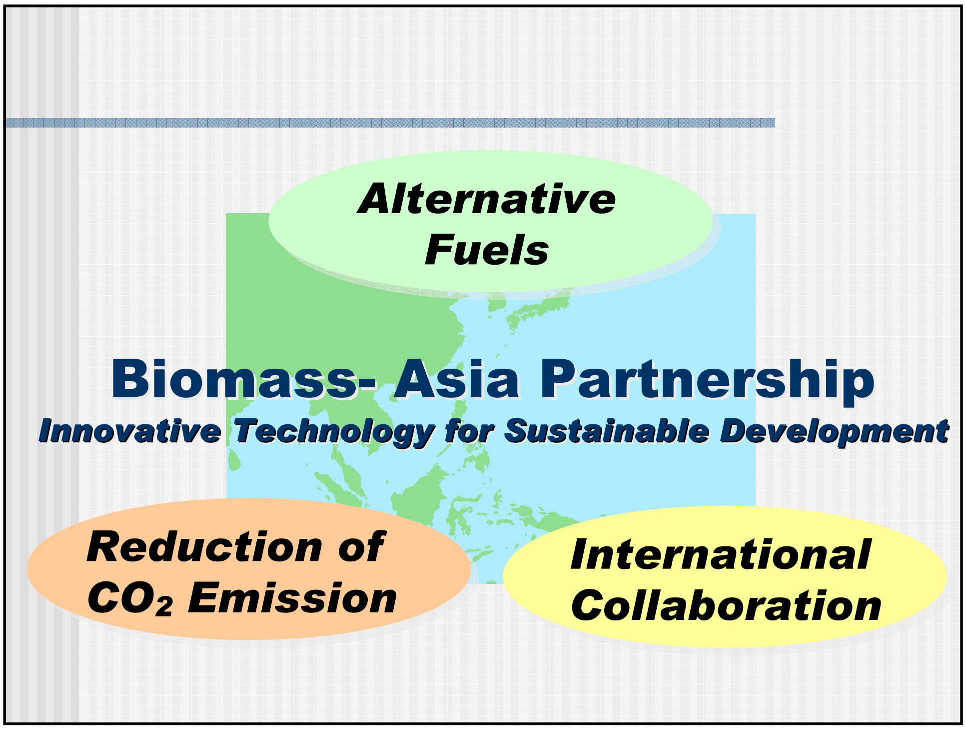
Landfilling
Ocean dumping
Incineration
Anaerobic digestion
Composting

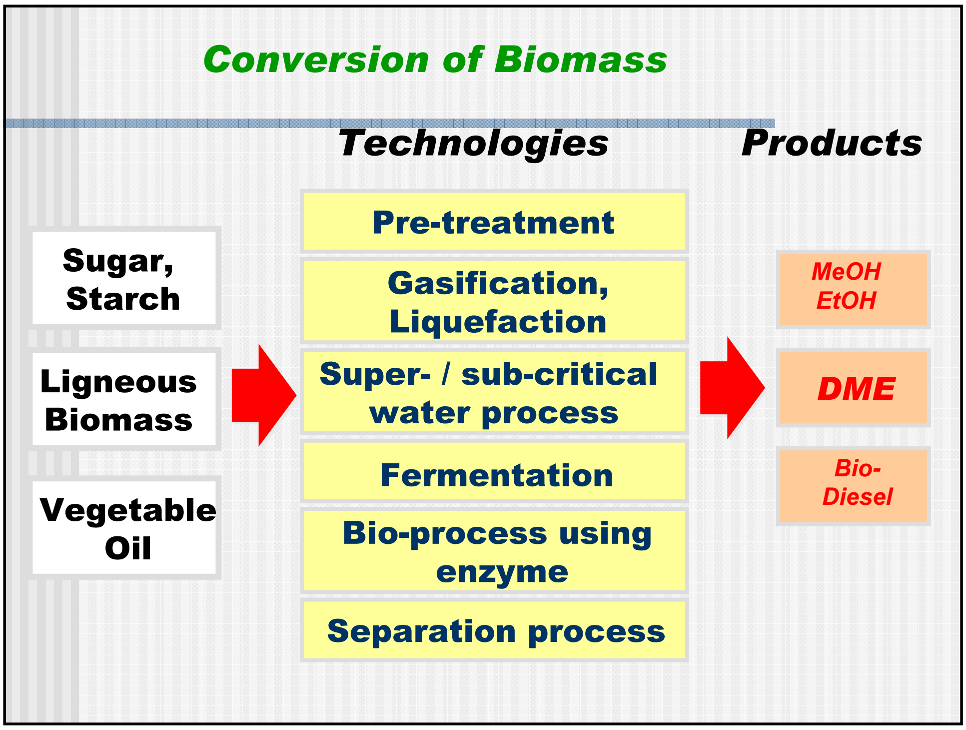
Oil production
/ The yield of heavy oil: 40～50%
(dry and organic basis)
/ Heating value: 8,000～9,000kacl/kg
/ Cost can be reduced by 30～50%。



実験プラント（200kg/h）のフローシート

DEMONSTRATION UNIT (5 t/d)


Alternative Fuels
Biomass- Asia Partnership
Innovative Technology for Sustainable Development
Reduction of CO_2 Emission
International Collaboration


Conversion of Biomass
Technologies
Products
Sugar, Starch
Ligneous Biomass
Vegetable Oil
Pre-treatment
Gasification, Liquefaction
Super- / sub-critical water process
Fermentation
Bio-process using enzyme
Separation process
MeOH EtOH
DME
Bio-Diesel


Thank You Very Much
E-mail:
syokoyama@bme.en.a.u-tokyo.ac.jp

Vulnerability and Sustainability of Biomass Production in Tropical Region

Mitsuru Osaki

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Laboratory of **RHIZOSPHERE ENVIRONMENT TECHNOLOGY**, Division of Bio-systems Sustainability, Graduate School of Agriculture

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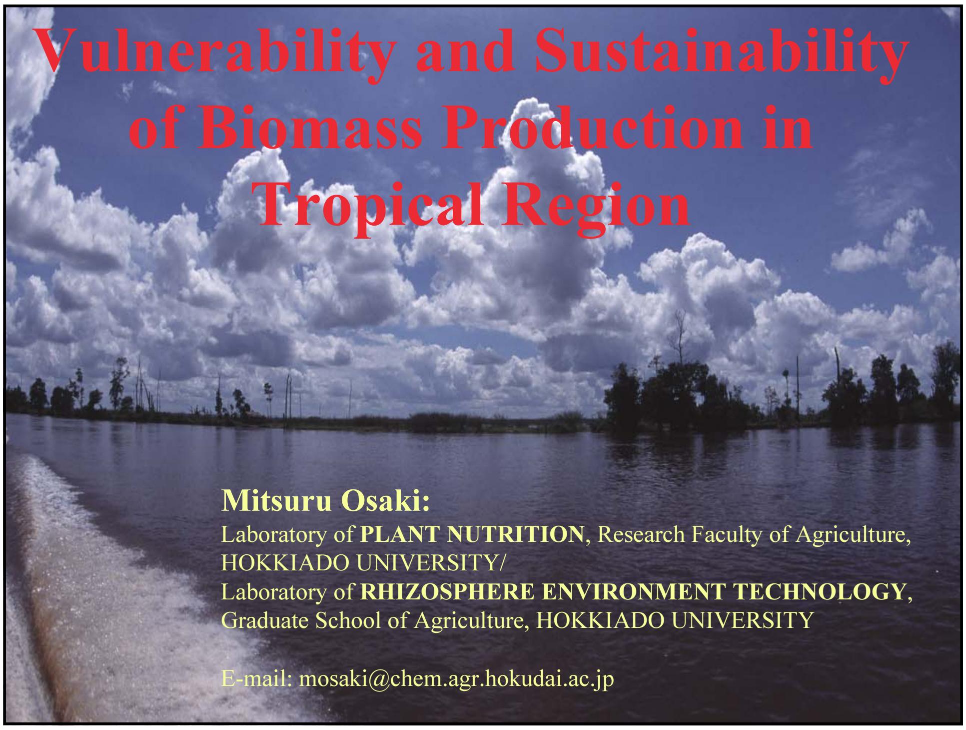
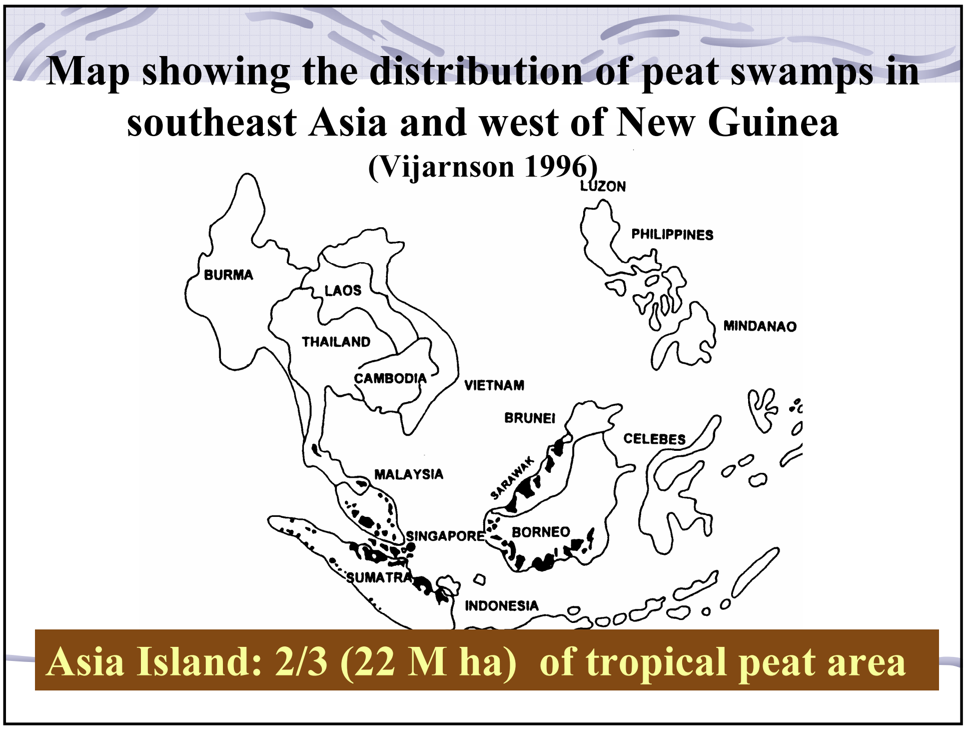
Abstract

About two third of the tropical peatlands area locate in Southeast Asia. The peatland ecosystems are unique and fragile, both as peat-forming wetland and tropical rain forest that widely recognized as tropical peat swamp forests (PSFs). Therefore, the peatlands area has been considered as the key ecosystem not only for conserving bio-resources and biodiversity, but also as carbon store in forests and peat soils, as well as controlling water resource. However, the economic and environmental values of this ecosystem have not fully been appreciated. The implementation of "Mega Rice Project (MRP)" in Central Kalimantan indicated that our knowledge on the nature of peatlands resource is still limited, and we had neglected that biophysical and socio-cultural aspects attached to the ecosystem. Consequently, we are now facing with problems of the land degradation, flood and drought, massive wildfires, biodiversity loss, illegal removal of timbers, and other negative socio-economic impacts. Our concerns, therefore, mainly focused on rehabilitation of peatlands and establishment of sustainable agro-system upon the destroyed, abandoned, and fire-damaged areas including cultivated areas adjacent the natural or semi-natural peat swamp forests.

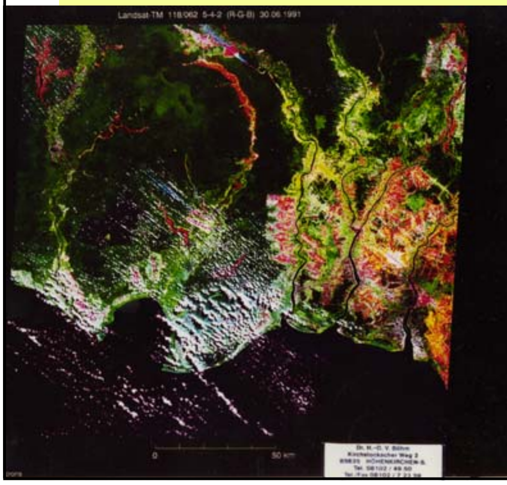
Also there are seriously poor and adverse soils in tropical regions. However native plants have developed several strategies for adaptation to poor and adverse soils, which include improving 1) the rhizosphere environment for nutrient uptake, and 2) nutrient utilization efficiency through anaplerotic pathways. In this paper, it is mainly discussed how to improve the rhizosphere environment, in other words, rhizosphere regulation techniques. Rhizosphere regulation is composed of integrated techniques, however these mainly consist of three technical strategies. The 1st strategy is the regulation of chemical compound secretion (e.g. acid phosphatase, organic acids, fravonoids, mucilage, etc.) from root. The 2nd strategy is utilization of symbiotic and associative microorganisms (rhizobium, mycorrhiza, free-living nitrogen fixing bacteria, etc.). The 3rd strategy is maintenance and stimulation of root activity, which related with high productivity and cluster roots.

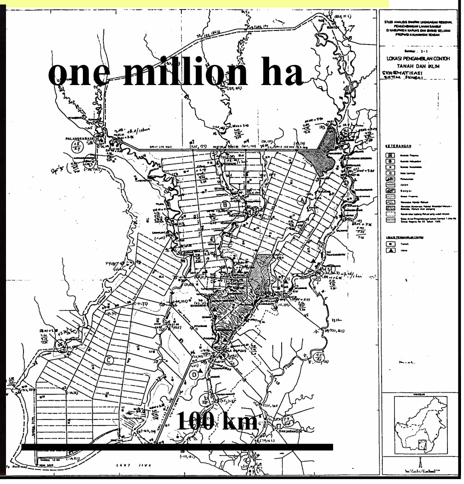
To establish the 1st strategy, we have performed to build transgenic plants introduced secretory acid phosphatase, which solubilizes organic phosphorus compounds in the rhizosphere, and phospho*enol*pyruvate carboxylase gene, which may have a role to increase the organic acid exudation from roots. In regards to the 2nd strategy, several interesting findings were revealed. Two rhizoplane bacteria, *Sphingomonas rosa* and *Burkholderia cepacia*, were isolated from *Melastoma* sp. grown in an acid-sulfate soil in Indonesia. The former, a biofilm-forming bacterium on plant roots, caused significantly better growth of the host plant in a N-free vermiculite bed under acidic conditions. The latter bacterium, which predominant around the root tips, showed an ability to solubilize aluminum phosphate under P-deficient conditions. Thus, it is likely that rhizoplane microflora may play one of the key mechanism factors of plant tolerance to adverse soils.


Vulnerability and Sustainability of Biomass Production in Tropical Region
Mitsuru Osaki:
Laboratory of PLANT NUTRITION, Research Faculty of Agriculture, HOKKIADO UNIVERSITY/
Laboratory of RHIZOSPHERE ENVIRONMENT TECHNOLOGY, Graduate School of Agriculture, HOKKIADO UNIVERSITY
E-mail: mosaki@chem.agr.hokudai.ac.jp


Map showing the distribution of peat swamps in southeast Asia and west of New Guinea
(Vijarnson 1996)
LUZON
PHILIPPINES
BURMA
LAOS
MINDANAO
THAILAND
CAMBODIA
VIETNAM
BRUNEI
CELEBES
MALAYSIA
SARAWAK
SINGAPORE
BORNEO
SUMATRA
INDONESIA
Asia Island: 2/3 (22 M ha) of tropical peat area

Total destroy of tropical peat by Mega Rice Project in Kalimantan

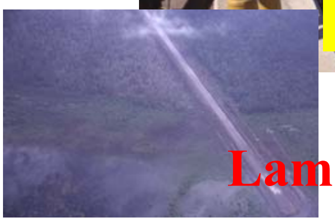




Only few gates were constructed!

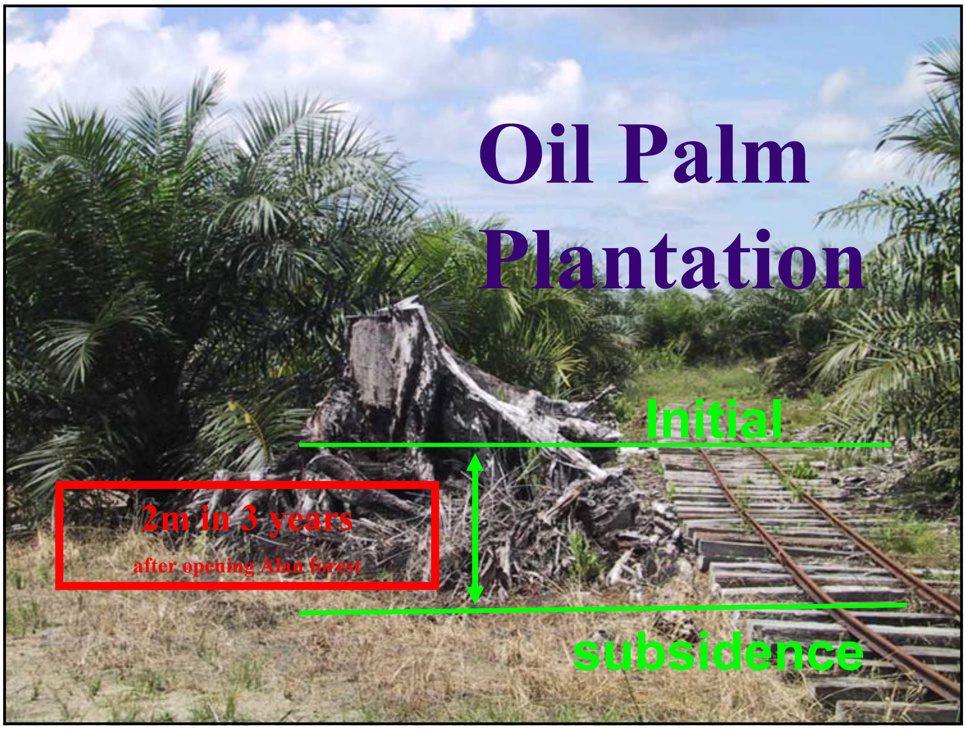
- No water management system
- Only for drainage, not for irrigation

Why?



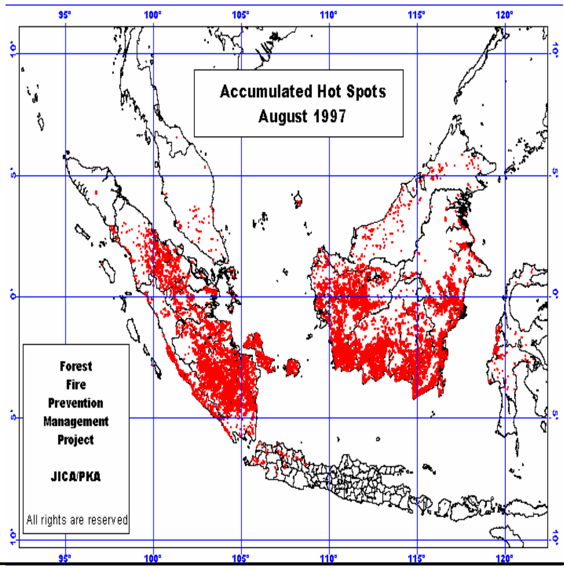
Lamunti in 1998

Totally Devastated

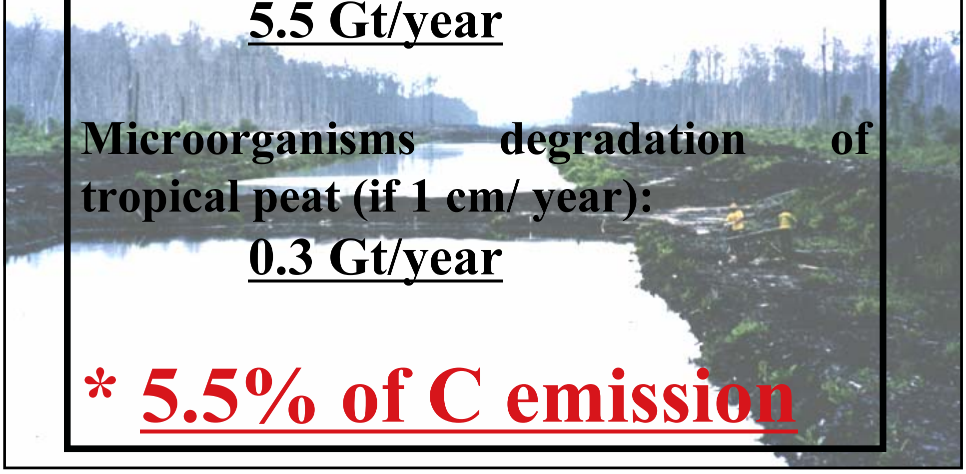

Oil Palm
Plantation
Initial
2m in 3 years
after opening Alan forest
subsidence


Destroyed
and Devastated Now!!
Totally Devastated
Lamunti in 1998

Wild fire spot in Southeast Asia in 1997



C emission through oxidation by microorganisms



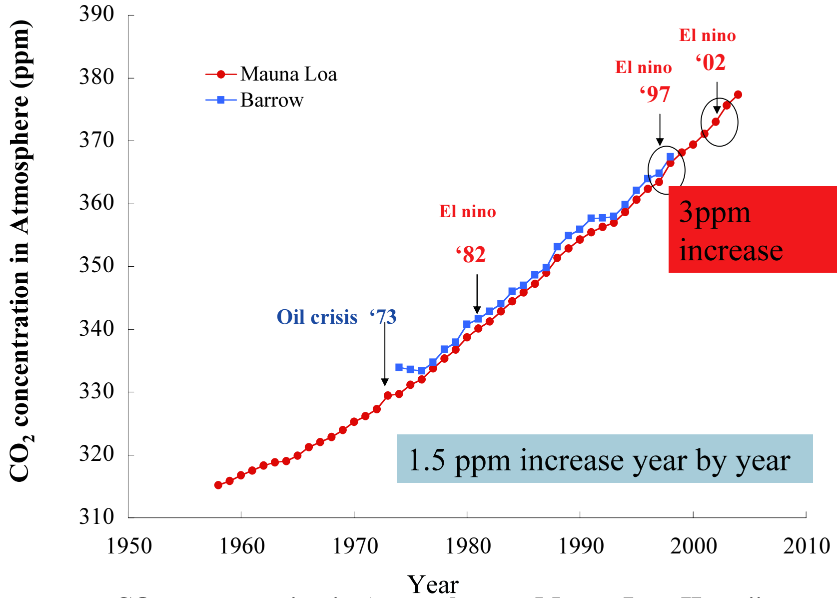
C emission by fuel:

<u>5.5 Gt/year</u>

Microorganisms degradation of tropical peat (if 1 cm/ year):

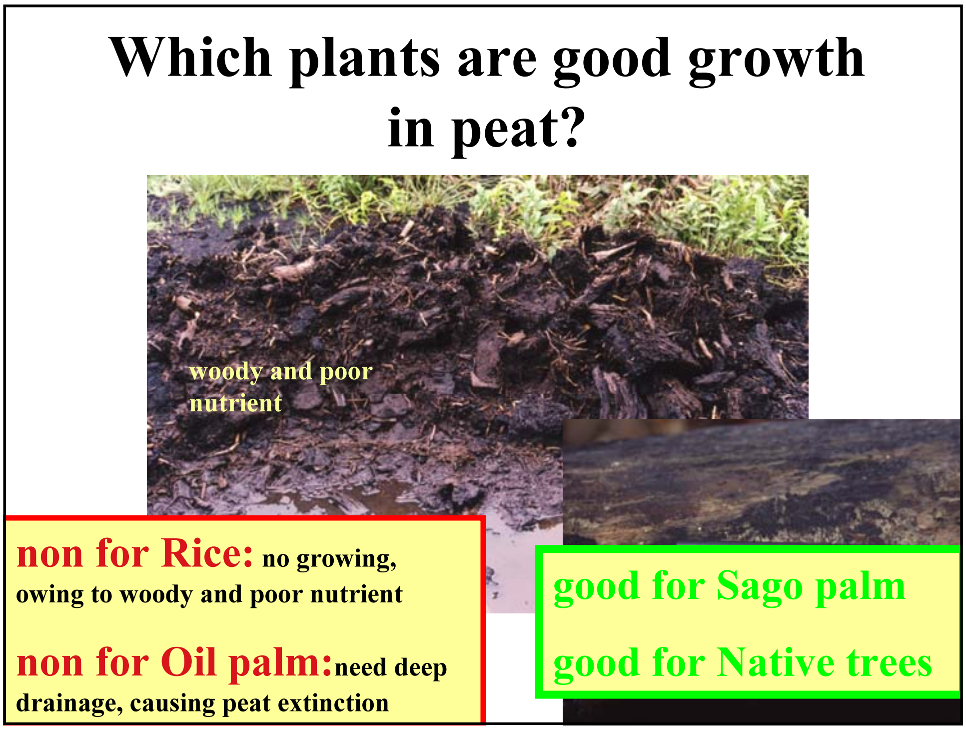
<u>0.3 Gt/year</u>

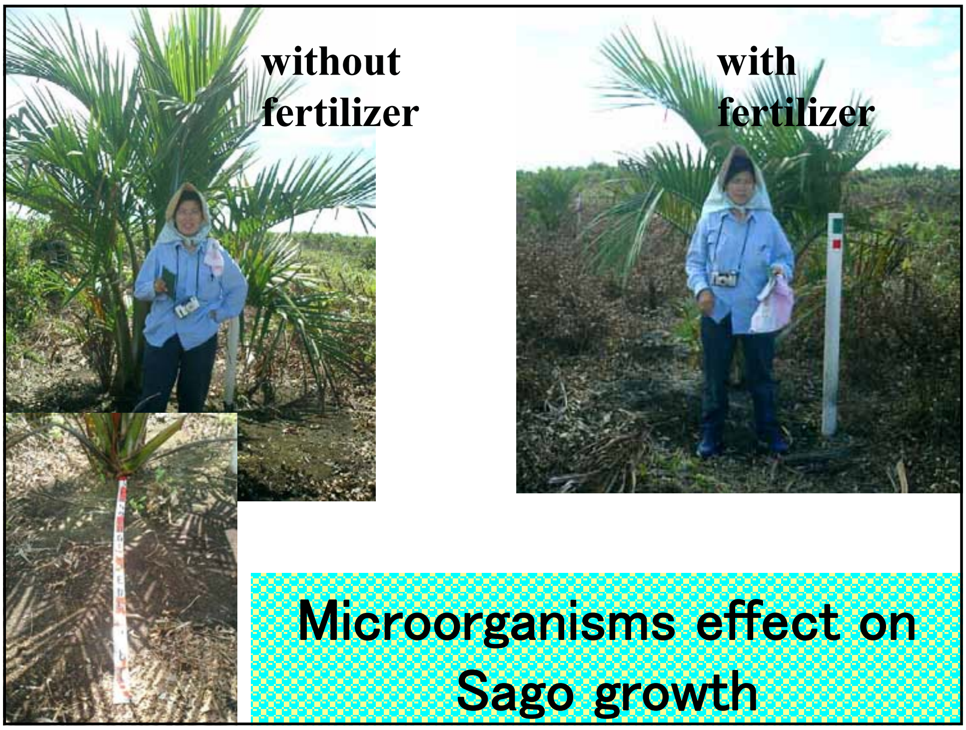
*** <u>5.5% of C emission</u>**



CO_2 concentration in Atmosphere at Mauna Loa, Hawaii, and Barrow, Alaska

Disaster by oil palm plantation in Malaysia


Which plants are good growth in peat?
woody and poor nutrient
non for Rice: no growing, owing to woody and poor nutrient
non for Oil palm: need deep drainage, causing peat extinction
good for Sago palm
good for Native trees


without fertilizer
with fertilizer
Microorganisms effect on Sago growth

5 years Sago palm after planting

No fertilizer

With fertilizer

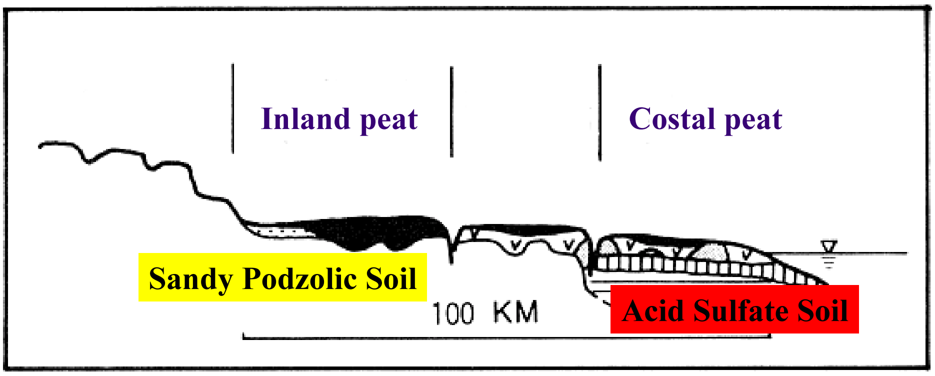
Aerial roots

with fertilizer

without fertilizer

Sogo with grass

Peat classification based on sub-soil



Peat formation process

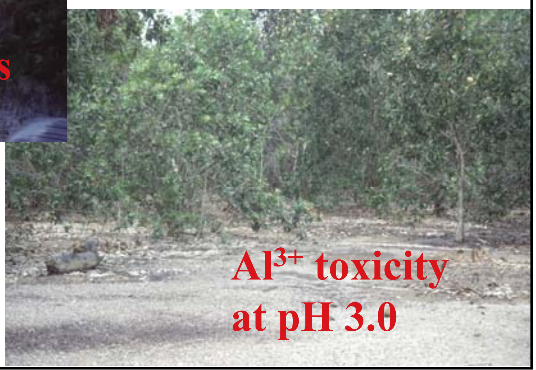
adverse soils (saline, poor nutrient) and anaerobic condition (flooded, rainfall) → poor microorganisms activity

lignin degradation → humic acids → acidification → poor microorganisms activity

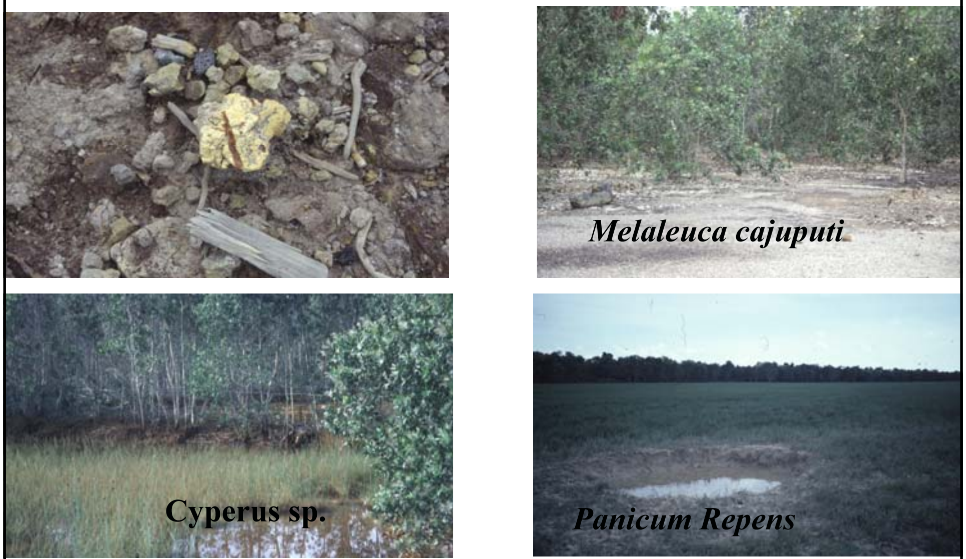
Appearing problem soils after peat extinction

Acid Sulfate Soil

Sandy Podzolic Soil



Acid sulfate soil

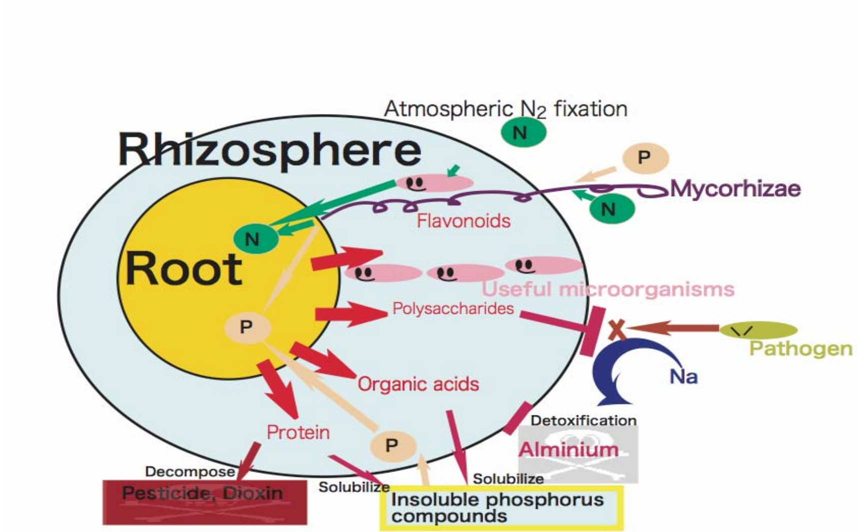


Sandy podzolic soil

What is Rhizosphere regulation？

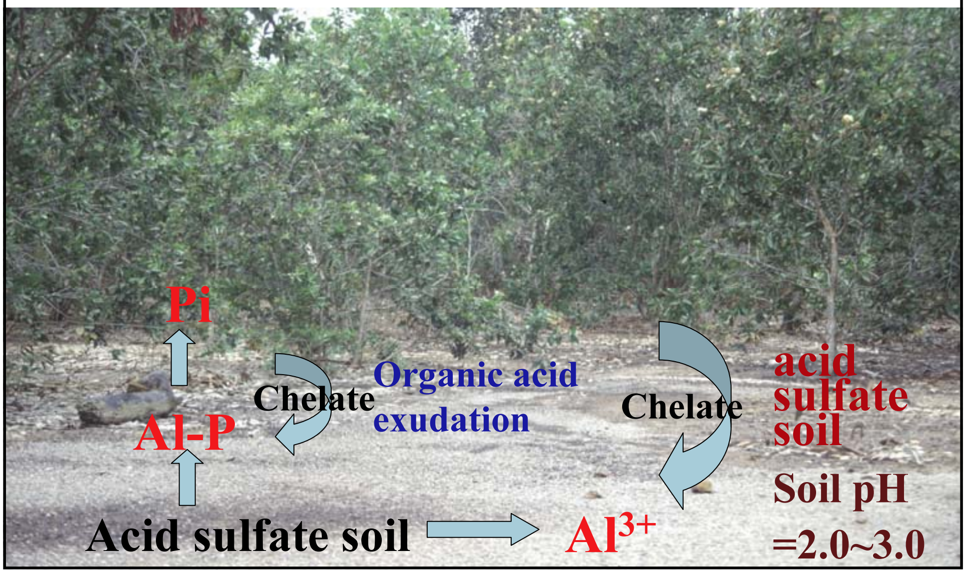
Strategy I: Root exudation

Strategy II: Symbiosis with microorganisms

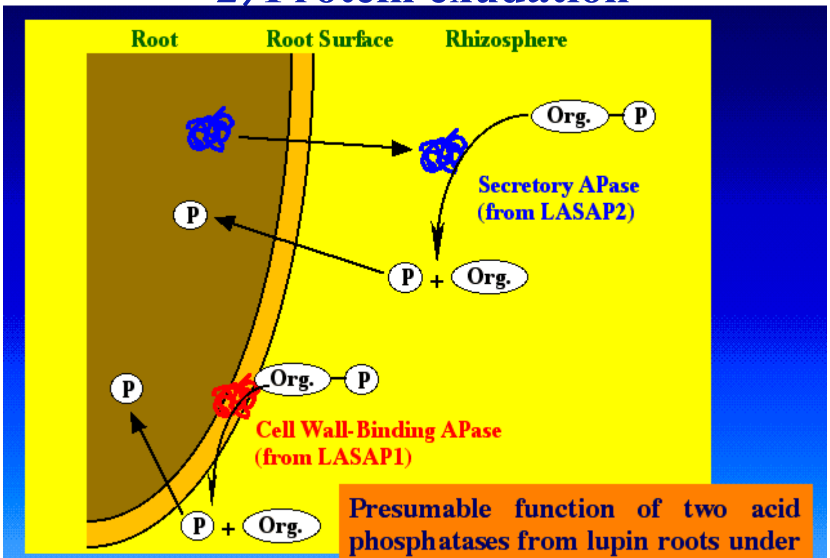


Strategy I: Root exudation

1) Organic acids exudation

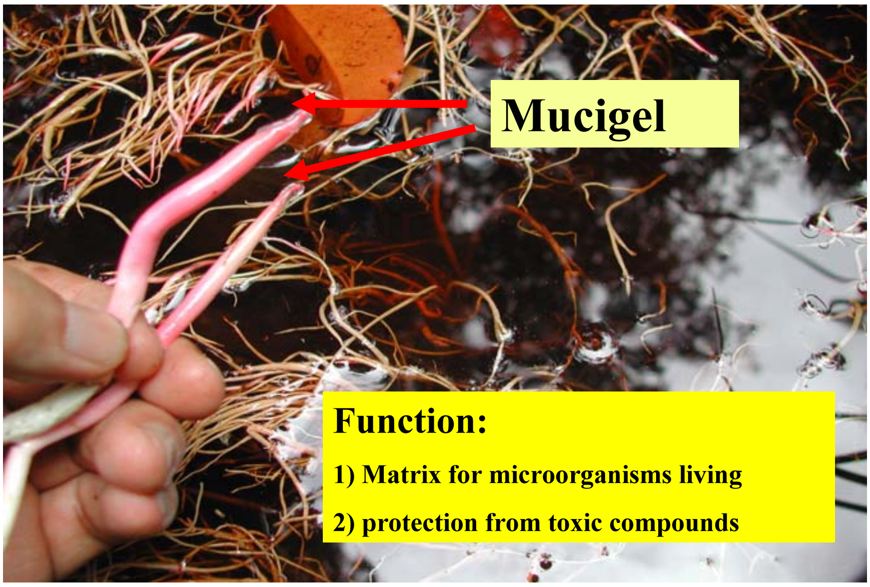


Strategy I: Root exudation
2) Protein exudation



Presumable function of two acid phosphatases from lupin roots under phosphate deficient conditions.

Strategy I: Root exudation
3) Mucigel exudation



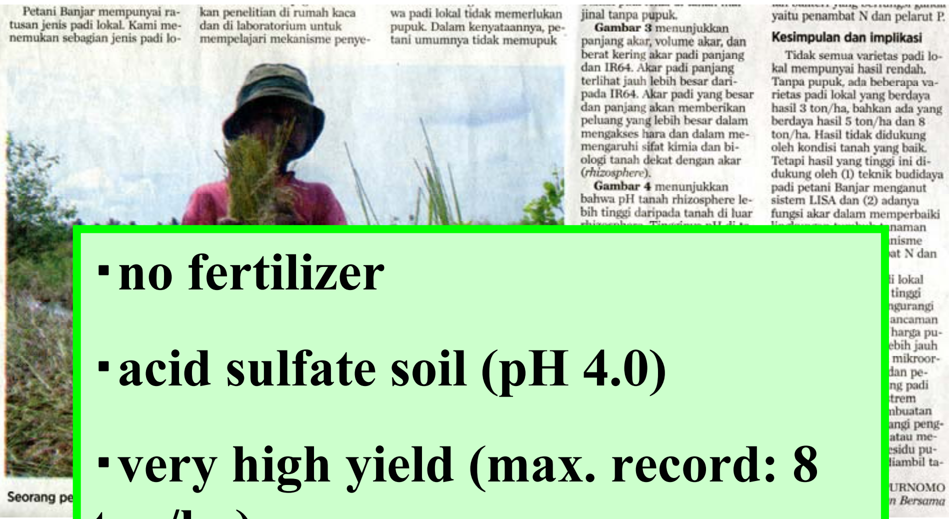
Strategy II:
Symbiosis with microorganisms

N2 fixing bacteria
(*Sphingomonas* sp.)

N_2fixing, then NH_4^+ release

1）N supply to roots2）pH higher

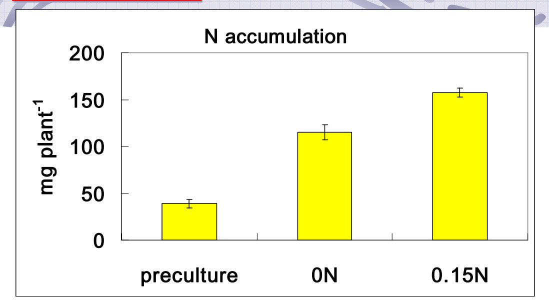
Paddi Panjang



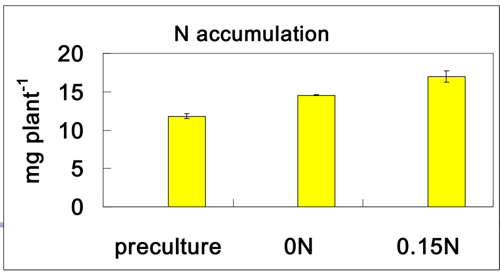
- no fertilizer
- acid sulfate soil (pH 4.0)
- very high yield (max. record: 8 ton/ha)

N_2 fixation

Melastoma

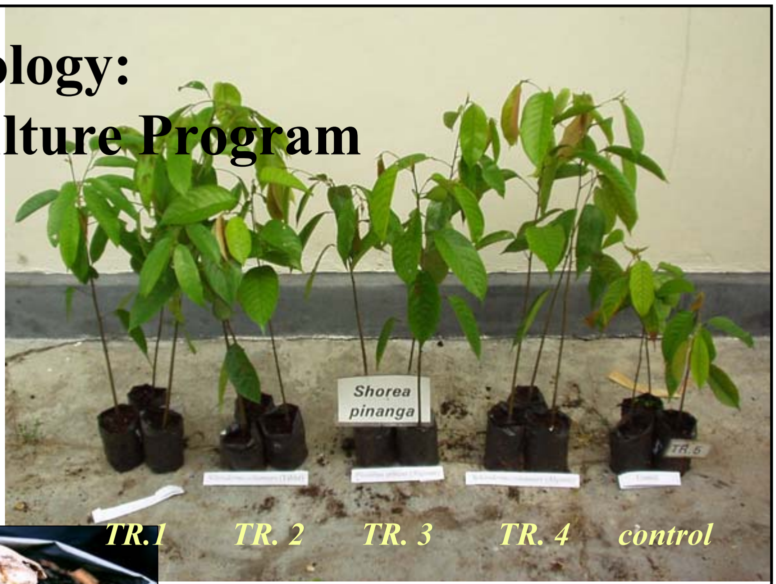


Melaluca



($P<0.05$ ANOVA Tukey's)

Technology: Cilviculture Program



Inoculation of Ectomycorrhizae

Seedlings culture medium: Charcoal,fibers, flyash, etc


Thank you for
your attention!!

Conservation of Biological Productivity Supporting Sustainable Biomass Utility

Takashi Machimura (Osaka University)

1. Introduction

In the emerging countries in south eastern Asia, a rapid economic growth raises energy demand quickly and stable and clean energy supply becomes a common requirement in these countries. Developing biomass utility for energy supply is one possible solution in these countries. However, biomass produced in rural agriculture and forestry regions has already been highly utilized for various purposes including heat and cooking fuel, fertilizer, livestock litter etc. in traditional ways. The additional demand for biomass may deform balances of production and utility. This report summarizes a few aspects to conserve biological productivity that supports sustainable biomass utility. Potential of GISs to assist the management of biomass production as well as environmental conservation is also shown with results of a case study.

2. Biological productivity and biomass products yield

Biological productivity is defined as annual biomass growth in unit area of an ecosystem. NPP (net primary productivity) is the common indicator of productions in natural vegetations, and is adaptive to forestry and agriculture productions, which is defined as annual net biomass growth of autotrophic organisms (*i.e.* green plants) in unit area, having the unit of tdw ha^{-1} y^{-1} or tC ha^{-1} y^{-1}. NPP strongly depends on climate condition especially on temperature, radiation and precipitation, and some NPP models were proposed based on the relationships between NPP and the climatic factors (*ex.* Miami model (Lieth, 1973) and Chikugo model (Uchijima and Seino, 1985)). The NPP determined by its relationship to climate can be considered as natural average productivity and has a meaning of potential productivity. In the other hand, actual productivity also depends on various site factors including soil, topography, water availability etc. Anthropogenic treatment factors such as plantation and thinning in forestry, and crop selection, irrigation, fertilization and multiple cropping in agriculture also affect to the actual productivity. Biomass product yield can be calculated by the product of potential productivity, site and treatment factors described above, and conversion factors, which represent the fraction of product yield to total biomass, for example the ratio of timber volume to total wood biomass. This calculation can easily be applied to the yields of byproducts (*ex.* straw and wood tip) and secondary products (*ex.* livestock), and furthermore, is applicable to the biomass yield model for selection of crop species, which is used to assist the regional planning of biomass production and utility.

3. Conservation of biological productivity in south eastern Asia

South eastern Asia is one of the world highest biological productivity regions according to high temperature and much precipitation. However it belongs to the monsoon climate zone which is characterized by clear wet and dry seasons, and its productivity is variable depending on the inter-annual change of climate. This region has common risks on biomass production and environmental issues caused by natural and anthropogenic reasons: The surface soil organic layer of tropical and sub-tropical forest is generally very shallow and is easily lost by erosion after deforestation especially on steep slopes. In irrigated crop lands, a special care is needed to avoid soil salinization caused by high potential evaporation. A monocultural wood plantation provides high yield, however it has the higher risks of pest and insect damages than natural or mixed forests. Forest fire frequently occurs during dry seasons in this region especially in El Nino years. Biodiversity loss by landuse change and water pollution by improper use of fertilizers and chemicals should be prevented. Keeping a proper intensity of biomass utility balanced with the productivity is indispensable to maintain high yield. For example in the case study of a cropland in Konken Province, Thailand, about a half of nitrogen loss by harvest is compensated with chemical fertilizer and another half with crop residuals and livestock manure (Matsumoto and Paisancharoen, 2005). This suggests that high utilization of the "unused" biomass such as crop straw and cattle manure for energy production may lead soil nutrient shortage and productivity reduction.

4. Potential of GISs for management of sustainable biomass production

GISs are useful tools for the regional management of biomass production and utility. It can combine regional information related to consumptions (ex. population, industry, traffic etc.) and biomass production as well as models described above. A case study shown below well indicates their potential. A forest ecosystem model was used to estimate biomass growth under different conditions of site yield class, wood species and stand age on a GIS. Two forest management strategies aiming to promote wood production and to protect land failure and biodiversity loss by means of different re-plantation treatments were compared through simulations for 30 years long. Soil carbon storage was used as the indicator of soil failure protection, and the potential habitats of animal species as that of biodiversity. The monocultural re-plantation management provided a large productivity, and the protective management extended the soil carbon stock and the potential habitat of Japanese black bear. GISs are capable to support planning the management of sustainable biomass utility.

The Workshop on
"Sustainable Societies and Industry Transformation with Zero Emission Initiatives"
6 Nov. 2006, New World Hotel Saigon, Ho Chi Minh City

Conservation of Biological Productivity Supporting Sustainable Biomass Utility

Takashi MACHIMURA
(Osaka University)

Human, Society, Global Environment
Research Institute for Sustainability Science

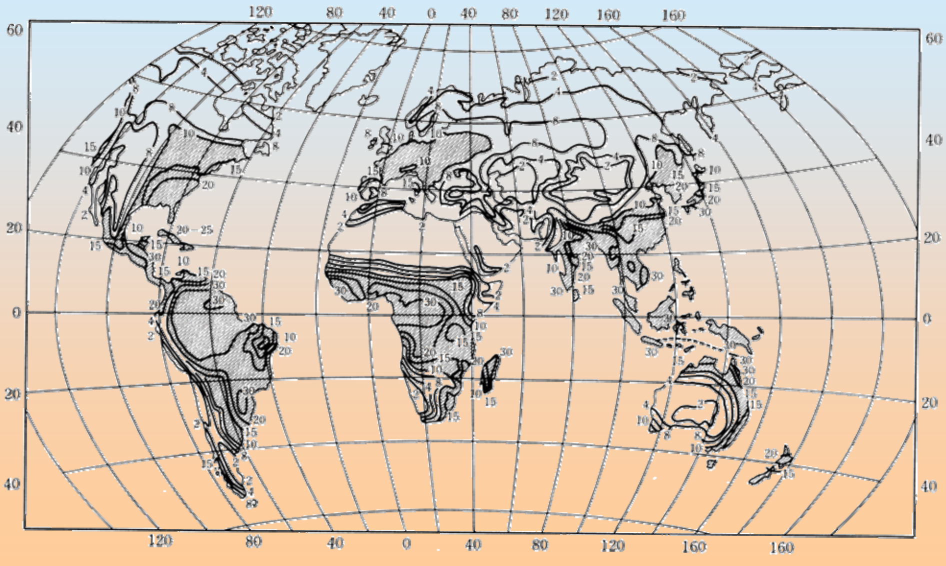
Biological Productivity

- Annual biomass growth in unit area of an ecosystem
  - GPP (Gross Primary Productivity)
  - NPP (Net Primary Productivity)
  - NEP (Net Ecosystem Productivity)

NPP (Net Primary Productivity)

- Annual net production of autotrophic organisms (*i.e.* green plants) in unit area
- Photosynthesis – autotrophic respiration
  = Annual growth of plants
  (live biomass growth + litter production)
- Unit: tdw ha^{-1} y^{-1} or tC ha^{-1} y^{-1}
- Basis of biomass production

World NPP map of natural vegetation (Efimova, 1977)



Climatic control to NPP (1)

- Temperature and precipitation

Miami model（Lieth, 1973; 1978）

$NPPt = 30 / [1+\exp(1.315-0.119T)]$

$NPPp = 30\,[1-\exp(-0.000664P)]$

$NPP = \min(NPPt, NPPp)$

NPP in tdw $ha^{-1}\ y^{-1}$

T: annual mean temperature (C)

P: annual precipitation (mm)

Climatic control to NPP (2)

- Radiation and precipitation

Chikugo model (Uchijima and Seino, 1985)

$NPP = 6.9[\exp(-0.216RDI^2)]R$

NPP in tdw $ha^{-1}\ y^{-1}$

R: annual net radiation ($J\ m^{-2}\ y^{-1}$),

RDI: radiative dryness index ($=R/lP$),

P: annual precipitation (mm),

l: latent heat of evaporation ($=2.5\times10^6\ J\ g^{-1}$)

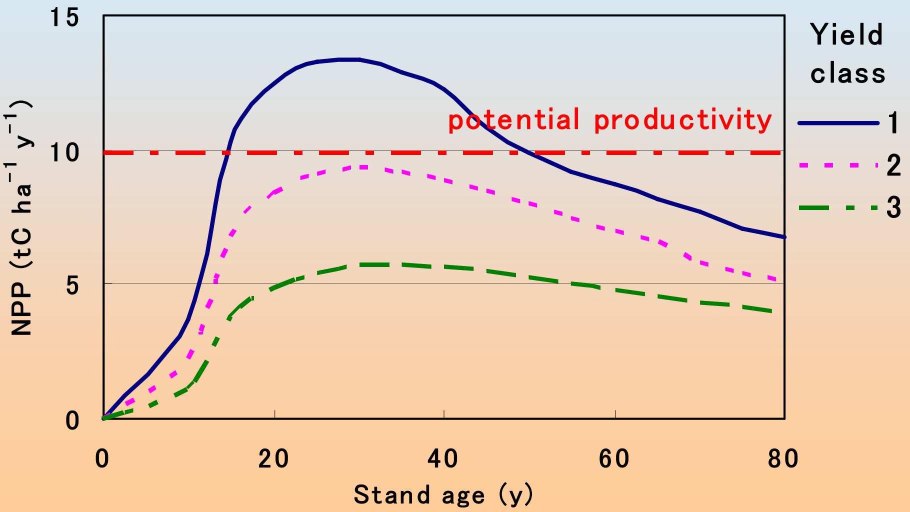
Control factors to productivity

- Climatically defined NPP
  = Potential productivity
  (average natural vegetation)
- Site factors affecting actual productivity (changeable by tree/crop species)
  – Soil chemistry and nutrient
  – Topography
  – Water availability

Anthropogenic treatment effects on actual productivity

- Forestry
  – Species selection
  – Plantation (artificial regeneration)
  – Thinning
- Agriculture
  – Crop selection
  – Irrigation
  – Fertilization
  – Multiple cropping

Actual productivity of Japanese cedar stand in central Japan

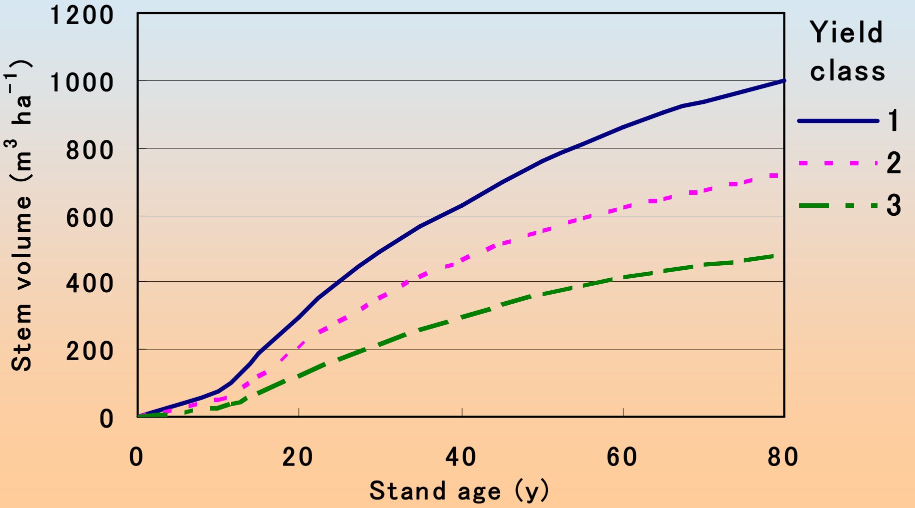


Productivity and biomass yield (1)

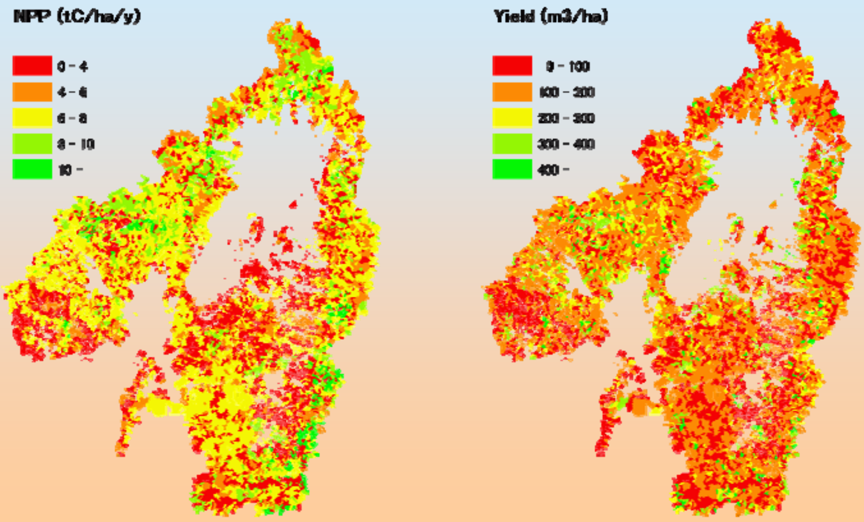
- *ex.* Timber production

Timber yield = potential productivity
×
site factors (soil, topography, species, age)
×
treatment factor (thinning)
×
conversion efficiency
(timber volume per total biomass)

Wood yield (stem volume) of Japanese cedar in central Japan



Estimated actual productivity and yield (stem volume) of forest in central Japan



Productivity and biomass yield (2)

- *ex.* Grain crops

Grain yield = potential productivity
×
site factors (soil, topography, species)
×
treatment factors (irrigation, fertilization etc.)
×
conversion efficiency
(grain mass per total biomass)

Productivity and biomass yield (3)

- Byproducts *ex.* Crop residuals (straw etc.)

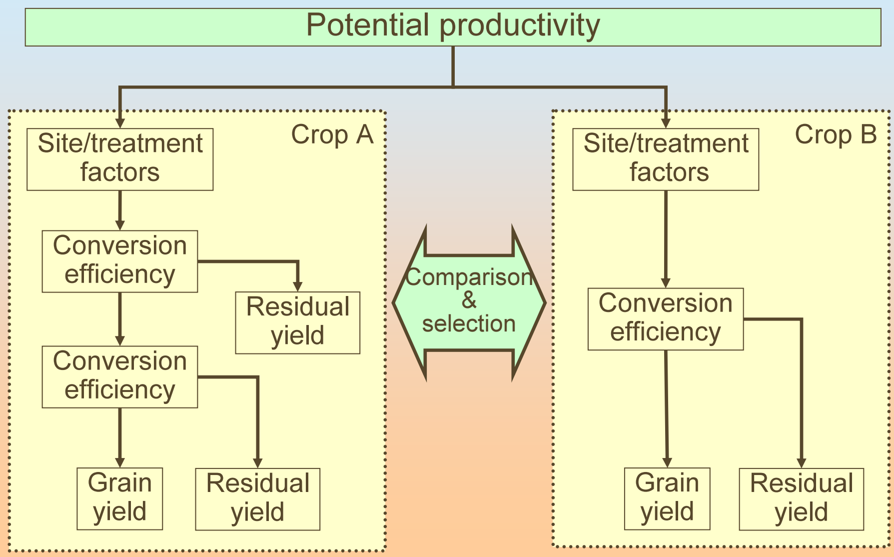
Residuals yield = potential productivity
×
site factors (soil, topography, species)
×
treatment factors (irrigation, fertilization etc.)
×
(1 – grain conversion efficiency)

Productivity and biomass yield (4)

- Secondary products *ex.* Livestock

Livestock yield = potential productivity
×
site factors (soil, topography, species)
×
treatment factors (fertilization etc.)
×
conversion efficiency
(hay yield per grass biomass)
×
conversion efficiency
(livestock growth per hay feeding)

Biomass yield model for selection of crop species



Conservation of productivity supporting biomass utility

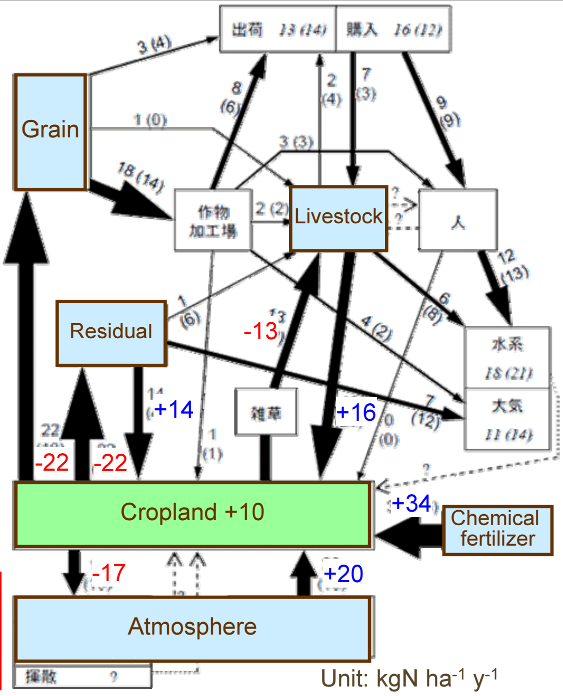
- Potential productivity is not controllable
- Maintaining site and treatment factors high which affect actual productivity
  - Suitable species selection
  - Suitable treatment
- Protection for environmental issues

Productivity and environment risks in biomass production

- Soil erosion and degradation induced by deforestation (clear cut)
- Soil salinization and degradation by exploitative or improper cultivation
- Pest and insect damages to monocultural plantations
- Forest fire
- Biodiversity loss by landuse change
- Water pollution by fertilizers and chemicals

Intense biomass utilization may lead productivity reduction

Nitrogen cycle in agricultural production and consumption at Konken Province, Thailand (Matsumoto and Paisancharoen, 2005)



Not all "unused" biomass is usable

Potential of GISs for management of sustainable biomass production

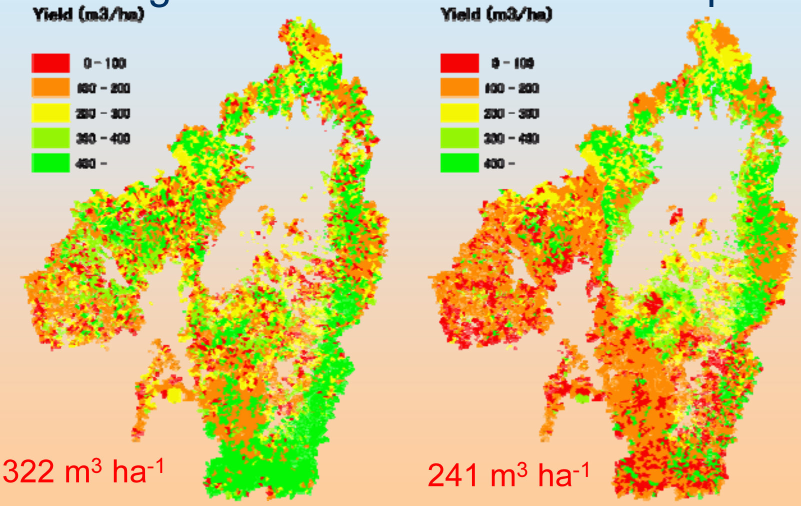
- Mapping conditions for and status of biomass production
- Tools for zoning and treatment planning
  landuse, species selection, treatment/ harvest/ reproduction schedules, transportation, conversion, consumption etc.
- Yield prediction
- Environmental conservation
  environmental indices

Example of GIS application on forest management for productivity promotion and environmental conservation

Management strategies

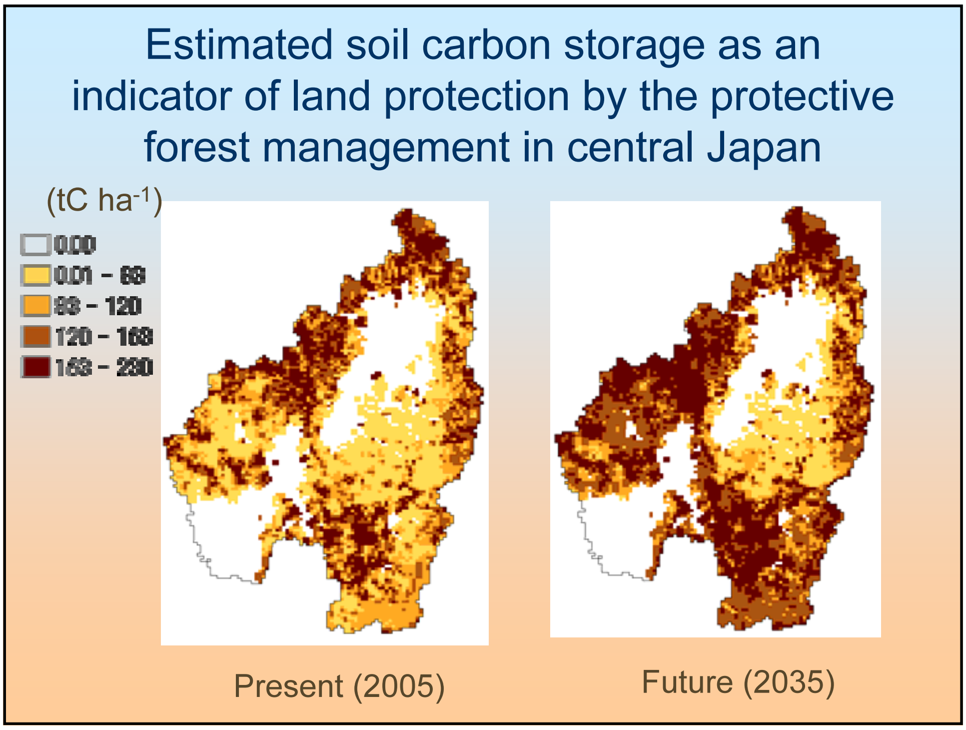
1. Productivity promotion
   - High yield class, low altitude and shallow slope, convenience for transportation
   - Plantation of rapid growing species
2. Land failure protection and biodiversity conservation
   - Natural preserve, low yield class, high altitude and steep slope
   - Preservation of natural forest and mixed plantation of deciduous broad leaf species

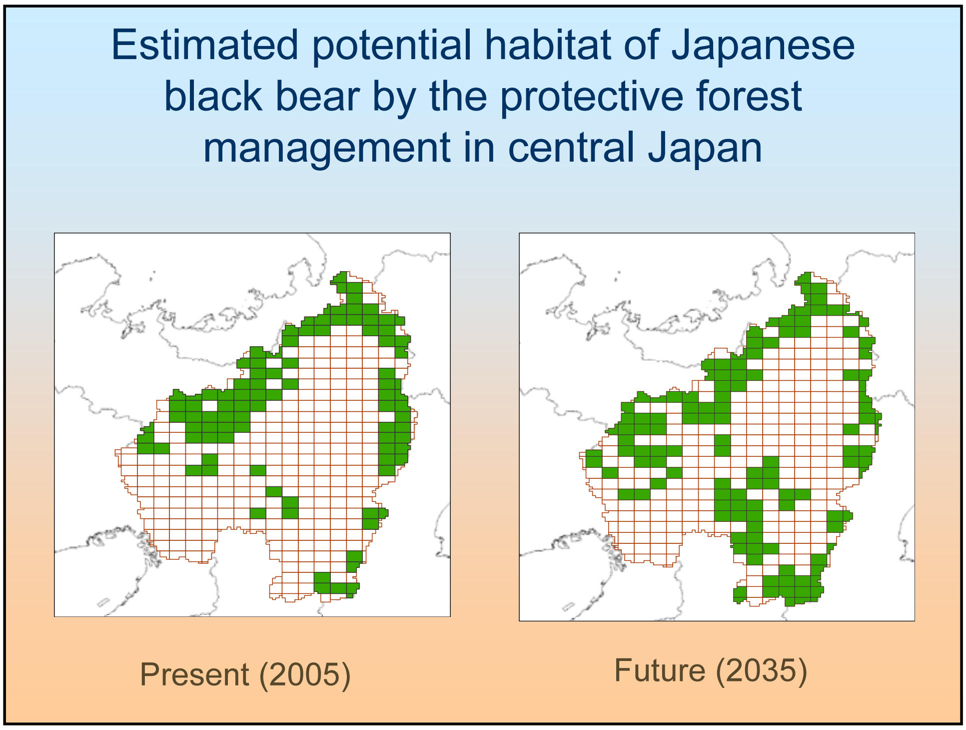
Estimated wood yield by the productivity promotion and protective forest managements at 2035 in central Japan



322 m^3 ha^{-1} — Productivity promotion

241 m^3 ha^{-1} — Protective


Estimated soil carbon storage as an indicator of land protection by the protective forest management in central Japan
(tC ha-1)
0.00
Present (2005)
Future (2035)


Estimated potential habitat of Japanese black bear by the protective forest management in central Japan
Present (2005)
Future (2035)

Toward sustainable rural development: combining biodiversity conservation with poverty alleviation - a case study in Phu My Village, Kien Giang Province, Vietnam

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Abstract

In many developing countries, there is a prevailing conflict between biodiversity conservation and the need for poverty alleviation. One possible solution for solving that conflict is to find ways that help poor people directly benefit from nature conservation activities. That approach has been tested in a wetland conservation project in Phu My village, Kien Luong District, Kien Giang Province. The 2,000-hectare seasonally inundated grassland, dominated by the sedge *Lepironia articulata* (Cyperaceae), in Phu My Village is the last of its kind remained in the Mekong Delta. In January 2004 a new model of protected area was established in Phu My Village. It is an "open" protected area where the local Khmer ethnic minority people are still allowed to harvest Lepironia as they have been doing for hundreds years. The project provides local people with skill training and production equipments so that they can make fine handicrafts from the Lepironia they harvest. The project also helps with marketing handicraft products to higher profitable export markets. After two years of operating, the daily income of people who participated in the project was on average twice as much as it was before the project. The unique remnant wetland is protected, which would have been otherwise turned into a rice cultivation area according to the previous land use planning of Kien Giang Province.

Toward sustainable rural development: combining biodiversity conservation with poverty alleviation - a case study in Phu My Village, Kien Giang Province, Vietnam

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University of Natural Sciences
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The conflict between nature conservation and poverty alleviation in developing countries

- Increasing human population resulted in tremendous pressure on natural resources
  - More and more lands allocated to agricultural production and human settlement
  - The harvesting of natural products/wildlifes gone beyond sustainable level
- Nature conservation is often given low priority in development planning

The way out?

→ Can poor people directly benefit from nature conservation?

Combining biodiversity conservation with poverty alleviation - a case study in Phu My Village, Kien Giang Province, Vietnam

PROJECT SITE

Phu My Village
Kien Luong District
Kien Giang Province

Phu My is among the poorest villages in Vietnam
Villagers are mostly Khmer ethnic minority

Phu My has the last extensive remnant of Lepironia wetland in the Mekong Delta

Local government wanted to turn the wetland into aquaculture and farm lands

The local Khmer people have long been harvesting Lepironia to make products such as sleeping sheet, rice bag

Weaving is a traditional activity of Phu My villagers

In September 2004, the Phu My Lepironia wetland conservation project was established

kien luong lepironia

Project office, managers and training facility

Skill training provided to villagers so that they can make fine handicraft products from Lepironia

Handicraft production

Income of local people increased substantially after one year

Handbags produced by the project

In November 2005, the first batch of handbags was exported to Japan

Wetland conservation activities

Wildlife monitoring

Invasive alien species control

Restoration of degraded wetlands

The return of the Eastern Sarus cranes
after one year of protection

A win-win solution

- Income of local people is increased
- Self-sustained business
- Wetlands are protected and wetland management is paid for by handicraft business

Speakers' Profiles in PART 1

Tohru Morioka, Ph.D.

Professor, Osaka University

Graduate School of Engineering

Director, Planning Department, Osaka University Research Institute for Sustainability Science (RISS)

Education:

1969 B. Eng., Dept. of Sanitary and Environmental Eng., Faculty of Eng., Kyoto Univ.

1971 M. Eng., Dept. of Sanitary and Environmental Eng., Graduate School of Eng., Kyoto Univ.

1974 Dr. Eng., Dept. of Sanitary and Environmental Eng., Graduate School of Eng., Kyoto Univ.

Professional Career:

1974-1976 Assistant Professor, Dept. of Environmental Eng., Faculty of Eng., Osaka Univ.

1976-1993 Associate Professor, Dept. of Environmental Eng., Faculty of Eng., Osaka Univ.

1993-1998 Professor, Dept. of Environmental Eng., Graduate School of Eng., Osaka Univ.

1998- Professor, Division of Sustainable Energy and Environmental Eng., Graduate School of Eng., Osaka University

2003-2006 Head, Division of Sustainable Energy and Environmental Eng., Graduate School of Eng., Osaka University

Other Appointments:

2006- Director, Planning Department, Osaka Univ. Research Institute for Sustainability Science (RISS)

2004- Director of the Environmental Risk Management Training Program, Osaka Univ.

Research Fields/Interests:

Global Environment Engineering, Environmental Management and Systems, Risk Management

Selected Publications (Books):

Design of Human Environment, Nippon Hyoronsha, 1986

Stories of Water, Kohdansha, 1989

Development/Conservation Technologies for Human Environment, Gyosei, 1994

Environmental Systems Research, Kyoritsu Pub., 1998

Industrial Society Towards Zero Waste Society, Morikita Pub., 1998

Handbook of Risk Research, TBS Britannica, 2000/20006

Phung Thuy Phuong, Ph. D.

Lecturer, University of Natural Sciences, Vietnam National University-HCMC

Department of Botany and Ecology

Education Record:

1998-2002 Ph.D. (Environmental Management), Wageningen University (The Netherlands)

1992-1994 Master of Sciences (Environmental Management), Asian Institute of Technology (Thailand)

1977-1982 Bachelor (Biology), University of Ho Chi Minh City

Field of Study:

Ecological Modernization Theory
Industrial Ecology
Public Participation in Environmental Management
Environmental Management of Industrial Estates
Urban Ecosystem

Ken'ichi Nakagami, Ph. D.

Professor, Ritsumeikan Asia Pacific University
Vice President (Development Affairs)
Vice President, Japan CIREC
Vice President, Association for Policy Informatics
Director, Society for Environmental Economics and Policy Studies
Director, Society of Water Resources and Environment
Member, Environmental Council of Oita Prefecture Governmental Municipal, Japan

Phan Minh Tan, Ph. D.

General Director, HCM City Dept. of Science & Technology
A former professor at Polytechnic University, HCM City (1992-2002)
Academic degree:
Doctor of Science in Chemical Engineering (1988)
Research fields:
Petrochemical technology
Environment management and Protection
Renewable energy

Akio Kobayashi, Ph. D.

Professor, Osaka University
Department of Biotechnology, Graduate School of Engineering
Research Institute for Sustainability Science (RISS)
Managing Director of KINKI Bio-industry Organization
Director, NPO MIMASAKA 21
Board member of:
The Japan Society of Bioscience & Biotechnology,
The Japan Society of Bioscience, Biotechnology and Biochemistry
The Japan Society of Environmental Biotechnology
The Society of Regulation of Plant Growth & Development

Dr. KOBAYASHI's Major is Plant Biotechnology. He serves as advisor to several different academic fields, including biomass production and establishment of eco-friendly know-how for switching the energy source from fossil fuels to Biomass. To realize this, eco-friendly promotion activity will be accelerated by rubber producing plants and GM plants. He also serves as acting director in several academic societies as a representative board member, such as Kinki Bio-Industry Promotion Council. He is the recipient of several major awards including; recognition from the Japan bioscience society. He is widely recognized as a thought-leader in the Japanese biosciences community. He gave a lecture on “The Importance of Heritage of Green planet, the Earth” in 2006 EXPO, Nagoya and his speech drew citizen’s attention very much.

Shinya Yokoyama, Ph. D.

Professor, The University of Tokyo

Department of Biological and Environmental Engineering, Graduate School of Agricultural and Life Sciences

Specialty:

Biomass energy conversion technology such as gasification, pyrolysis, and liquefaction

Waste materials management

Carbon dioxide mitigation strategy

International cooperation strategy for the global warming control

Academic/social contribution:

Vice President, Japan Institute of Energy

Director, Japan Society of Energy and Resources

Chairman, SETA (Sustainable Energy for Transportation through Agroforestry)

Hoang Huu Cai

Nong Lam University

Mitsuru Osaki, Ph. D.

Professor, Hokkaido University

Executive Advisor

Director, Sustainability Governance Project (SGP)

Division of Biological Resources and Production, Research Faculty of Agriculture

Academic Degrees:

B. Sc. 1976 Hokkaido University (Agriculture)

M. Sc. 1978 Hokkaido University (Agriculture)

Ph. D. 1981 Hokkaido University (Agriculture)

Professional Appointments:

1981-1982 Research Fellow, Laboratory of Plant Nutrition, Faculty of Agriculture, Hokkaido University

1982-1984 Associate Scientist at CIMMYT (Mexico)

1984-1997 Assistant Professor, Faculty of Agriculture, Hokkaido University

1997-1999 Associate Professor, Faculty of Agriculture, Hokkaido University

1999-2001 Associate Professor, Graduate School of Agriculture, Hokkaido University

2001-2006 Professor, Graduate School of Agriculture, Hokkaido University

2006- Professor, Research Faculty of Agriculture, Hokkaido University

Research Interests:

Rhizosphere regulation

Plant-soil-microorganisms interaction

Plant Productivity through carbon-nitrogen metabolisms

Al tolerance and phosphorus deficiency of plants grown low pH soil

Human-Dimension on ecological management Global Land Project

Takashi Machimura, Ph. D.

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Research Institute for Sustainability Science (RISS)

Specialties:

Biological environment

Micro meteorology

Plant physiology and ecology

Current studies:

Long- and short-term effects of boreal forest disturbances on permafrost stability and ecosystem carbon cycle

Multi-criterion evaluation and future projection of forest ecosystem services by means of ecological models

Physiology and environmental effects of reverse sap flow in vascular plants during rainfall

Tran Triet, Ph. D.

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Chair, Department of Botany and Ecology

Vice Dean, Faculty of Biology

Academic degree:

Ph. D. in Land Resources (University of Wisconsin-Madison, USA, 1999)

Professional affiliation:

Member of the Invasive Species Specialist Group

Member of the IUCN's Commission on Ecosystem Management

Director of the Southeast Asia Program, International Crane Foundation (USA)

Research fields/interests:

Wetland ecology and management

Alien invasive species