

Conflicts and Anarchy in Indian Natural Resources Governance: Need for a Paradigm Shift.

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Abstract

Past over a decade, the Indian economy clearly seems to have followed a high growth trajectory breaking all previous records and consistently growing at a GDP over 7 percent. The main contributor being the service sector contributing around 50 per cent of national income and growing at the rate of double digit. Still today, a vast majority of the people continue to remain dependent on the natural resources-land, water, forests and fisheries. The importance of natural resources was recognised during colonial rule in India both in terms of development as well as a source of revenue generation. Immediately after independence, a consensus emerged; the state became a dominant player in development and launched many programmes leading to commoditisation of natural resources and capital accumulation. Natural resources conservation received low priority. Access and control of natural resources therefore, became convenient means for wealth accumulation in which the state played a partition role in a differentiated social structure leading to conflicts and chaos all over the natural resources.

In this paper an attempt has been made to map out these colossal conflicts around natural resources in India. The conflicts are amplified due to institutional failure, technology and market penetration in which state played a divisive role, seemingly colluded with privileged and powerful segment of the society. The appropriations of critical natural resources by powerful have been challenged by the NGO's, social activists, civil rights groups and others. Recently, NGO's and civil societies agenda have been adopted in mainstream policy, like the involvement of community in forest and water resources management, without substantial progress in space for community involvement. It is argued that the Indian natural resources are facing challenges that can not be addressed in the current policy and an analytic framework and a paradigm shift is required. The new paradigm is to be based on everyday realities within which people live and sustain their livelihood. Tentative outline of the paradigm shift needed is also highlighted in the paper.

Bridging the Formal-Informal Gap? Changing Institutional Arrangements in Communal Forest Management in Thailand

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Abstract

One of the reasons that many developing countries had failed to conserve their natural resources is that they had been unsuccessful to construct effective formal institutions in the process of rural development. On the other hand, many, though not all, local informal institutions had successfully managed their communal resources and livelihoods in certain conditions. Policies on community-based natural resource management (CBNRM), in many cases, can be understood as measures to narrow this great formal-informal institutional gap. To what extent and in what sense did it succeed? How had the evolutions of both formal and informal institutions created harmonies and contradictions? Such historical (if not, dynamic) perspective of institutional change is important in addressing possibility and limits of current modernization process of resource management. In this presentation, I try to answer above questions by exploring evolution process of formal and informal institutions in communal forest management in Thailand. The brief history of the formal institutions on forest management is firstly explained. Then the competing logics of local collective action are shown in order to understand local institutional changes. Finally, some of the composite effects on resource management and people's livelihoods are pointed out from the viewpoint of the development of "sustainable biosphere".

How to Assess the Sustainability of Our Humanosphere? Towards the Development of *Humanosphere Index*

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Abstract

We have launched the development of the index for assessing the sustainable humanosphere. Considering the historical process of the complication, the environment we live could be separated to three spheres: geosphere, biosphere and humanosphere. To design our future, the harmonization of the each sphere's sustainability is essential. Based on the review of the ecological footprint and human development index, here we present the core ideology of the new index.

Sustainable interaction between two environmental spheres and the production activity by the human beings should be designed with consideration of the globe biological capacity, not only in a sense of resource withdrawal but purification of the substance that can harm our future possibility.

To avoid the dilemma between environment and development, we need to re-think what good life is. Regarding human development, economical activity itself might not be a good indicator as far as the extreme poverty is reduced. Further, health is vital for human activity so disability adjusted life expectancy was included to take account of the burden of disease, and education index was modified to focus on primary and secondary education. The process of the index development raised the key question for this research: how and what kind of quantitative indices can express the human well-being. Parallel discussion on the human well-being (conceptualization, quantification and integration) is vital for the next step.

Session 2 by Initiative2
Learning from the Dynamics of Geosphere and Biosphere

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For the seeking of sustainable humanosphere in Asia and Africa, creating a new paradigm for relationship between nature and human is urgently needed as we have discussed since 2008 by using a concept of “Nature-Inspired Technologies and Institutions”. In the process of discussion, it has been found that 1) nature and human have mutually influences and contentiously change each other, not having a one-way impact, 2) technology and institutions were developed by the mutual forces of change in the local nature and society, and 3) new paradigm should be based on those understanding of relationship between nature and human. We will, therefore, discuss the following points in this session from an integrated approach of natural science and area studies.

1. Spatial and temporal range of mutual forces of change both in nature and human activity.
2. Reassessment of local technology and institutions that mutual forces of change are embedded and geospheric and biospheric influences are considered.
3. Implication of mutual forces of change in local society for global changes.

Interrelationship between Hydrological Cycle and Human Activities

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Abstract

Overcoming regional water problems requires an understanding of both natural conditions and social and historical changes in regional water policy. Hydrological cycle and climatic condition control human activities. However, in some cases, human activities could lead to irreversible environmental destruction and hydrological change.

For example, Central Asian nations face serious water problems, and we here review the circumstances surrounding water resources in the Syr Darya and Amu Darya River basins in terms of water management changes and climatic trends. Under the Soviet Union's "planned economy" policy, many dams and other irrigation facilities were constructed in the two river basins, due to the Communist Party's prioritization of cotton and rice cultivation in downstream Uzbekistan and Kazakhstan. The huge increase in water diverted to irrigated areas dramatically decreased water flowing into the Aral Sea, disturbing the balance between water inflow and evaporation from the lake, drastically reducing the lake area and rapidly raising the saline concentration from 10‰ to 35‰. The combination of these processes has triggered many problems, including the disappearance of fisheries from the Aral Sea, the contamination of basins by agricultural chemicals, the damage to health of local inhabitants including a lower life expectancy, and the deterioration of the environment and basin ecosystems.

Almost all causes of water problems in this region are due to human activity and water resources management, and will be difficult to solve. However, these problems must be solved step by step using the scientific, engineering and political approaches. I recommend concrete measures for appropriate irrigation and better basin water management.

Biodiversity and Ecosystem Function in the Human-made Landscape: Birds Transport Human-Derived Nutrients into Urban Forests.

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Abstract

Biosphere is easily affected by Humanosphere. For example, biodiversity changes in the human-made landscapes are well known in many kinds of ecosystem as cities, rural landscape, and plantation. Centuries before, when humans settled in a narrow area, its impact on biosphere was not as huge as present. After the industrial revolution, human being has changed our landscape and ecosystem, causing biodiversity loss. Since the impact of land use change on ecosystem lasts for a long time, it is essential to understand the dynamics of biodiversity and ecosystem function in relation to landscape change. A case study of bird diversity and nutrient cycle in urban landscape will be presented here, to discuss the indirect effect of land use change in cities. In urban landscapes, bird species decrease and biomass increase compared to forest-dominated landscape. Urban birds contribute to allochthonous nutrient flow from residential areas to fragmented forests by consuming food in residential areas and depositing feces in forests. The estimation shows that, in urban forests with crow roosts, birds contribute 2.7 times the amount of allochthonous P contributed via other pathways; and 0.66 times the amount of allochthonous N input. High stable isotope ratios, $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$, in crow roosts indicate that they eat foods such as livestock meat, C_4 maize or fish. Urban landscape support high avian biomass, which provides large nutrient input in fragmented forests with crow roosts. Therefore, humanosphere interact with forest ecosystem via birds.

Coping with Natural and Socio-economic Uncertainty in Arid Africa

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Abstract

The interaction between nomadic pastoralists and the arid environment of Africa has been viewed by the biased theory of “East Africa cattle complex” and “the tragedy of the commons” in the 20th century. Although recent disequilibrium ecosystem theory reconsidered nomadic pastoralism as an optimal adaptation strategy for natural hazards, pastoral societies had experienced dramatic socio-economic transformation and had changed rapidly. In search of human-nature coexistence in the arid area of Africa, a comprehensive approach combining field observations with a longitudinal and comparative study on the Rendille pastoralists of northern Kenya was attempted. The results show that the Rendille have changed from nomadic to semi-nomadic under the influence of development projects and relief efforts in the past three to four decades. However, by continuing communal use of rangeland and water resources, setting high value on livestock and maintaining high mobility of livestock at herding camps, adapting social institutions such as age system and cooperative relationship in herding tasks, and challenging new opportunities, they have achieved certain success in maintaining pastoral subsistence. The case study further suggests that it is necessary and important to understand the functions in local technologies and institutions, and encourage the mobility, flexibility, and creativity of pastoralists for future sustainable development.

Session 3

Biofuel as a Global Force of Change

Takahisa Hayashi

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Our project on the forestry model of sustainable humanosphere was originally a comprehensive interdisciplinary study of local societies dependent on forestry products, to examine the impact of frontier technologies of molecular biology, wood engineering and forest science on land use, commercial forestry, commercialization of forest waste, employment generation, changes in customary law, local administration and local politics.

Environment and energy are challenges facing sustainable humanosphere today. According to the International Energy Agency, global demand for energy is expected to increase by more than 20% by 2020, based on marked demand for energy in Asia and Africa. Fossil fuel will be required for more than 30% of this increase. Increased consumption of the fuels will steadily enhance emissions of carbon dioxide, increasing greenhouse gases in the atmosphere. Reducing dependence on fossil fuels is a challenging priority in restoring the environment and the economy to a sustainable humanosphere and biosphere.

Reducing dependence on fossil fuel consumption requires breakthroughs in science, based on the forestry model of sustainable humanosphere in Southeast Asia. Biomass-based biofuels, such as cellulosic ethanol, are a potential source of renewable energy which can be generated without affecting food production. They could also offer a solution to both pollution and greenhouse gases because plants that are grown as biofuel feedstocks reabsorb the carbon dioxide emitted when the biofuels are burned.

Bioenergy crops include trees such as falcate and grasses such as sugarcane and others grown specifically for energy production. The challenges facing bioenergy include the agroforestry settlement of sustainable humanosphere, development of next generation bioenergy crops and design of enzymes and microbes with novel biomass-degrading capabilities. There are many potential energy crops among trees and grasses that have not markedly benefited from the years of agricultural research devoted to breeding traditional crops such as corn, wheat and rice.

Our group will offer students, postdoctoral staff and young scientists interdisciplinary research discussions covering a broad range of biofuel-related fields. We seek to develop new forms of frontier science and technology that sustainably integrate the humanosphere and biosphere.

Proposed text "Drivers for Sustainable Use of Bioenergy on a Global Scale"?

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This contribution will go into the most recent insights in potential biomass availability on longer term, next to meeting global food demand, protecting biodiversity and forests and sustainable management of water reserves and soils. Those insights can be translated to what it means to comply with sustainability criteria for biomass production and use for energy, as they are currently proposed by various governments, stakeholder networks and NGO's. Furthermore, the linkages between (more) sustainable governance of land-use, rural income and development and modernization of agriculture will be highlighted. This is an essential and new element in securing sustainable production of bio-energy and links to management of land-use for agriculture and livestock at large. It will be debated what strategies and bioenergy production systems may be pursued to achieve not only renewable energy production but contribute to (more) sustainable development at large. Some concrete examples on Europe, Latin America and Sub-Saharan Africa will be included to illustrate this. A key route is provided by production of perennial crops, generally on lower quality land and their utilization for 2nd generation biofuels production.

R&D on Bio-Fuel Production and Asian Biomass Strategy

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Due to the rapid economic development and the large population in Asian countries, future increase in their energy consumption / greenhouse gas emission is apprehensively anticipated. Many of these Asian countries are rich in biomass resources. The potentials of biomass utilization are commonly understood with their impacts on the environment /society. Networking the organizations in Asian countries is very important for the sustainable biomass utilization both in terms of policies and of R&D in each country. Towards the future scenario and strategy for the sustainable biomass utilization in Asian countries, as a countermeasure against the global warming, more effective but sustainable biomass utilization technologies are to be established, contributing to the creation of local communities and their rural / forestry / fishery industries. Most adequate technologies should be developed to secure and apply sustainable biomass resources to meet the mutual requirements.

Biomass Technology Research Center (BTRC) of AIST has been conducting the technical developments and organizing the social system for biomass utilization to establish a sustainable society not only in Japan but also in the world in terms of the three important targets, which are described as follows; 1) Ethanol production from woody biomass; 2) Biomass to Liquids(BTL) process, and 3) Study on Biomass Total System.

Session 4.

This session aims to discuss the potentialities of mediating the biospheric perspective on life and the world in Asian and African regions with modern technology and institutions so as to create sustainable humanosphere. In many parts of Asia and Africa, there are local knowledges that see and manage interconnected relations of life between human society, animals and plants, and elements of geospheric nature, such as earth, wind, fire and water. This kind of knowledge has been criticized in the modern West as unscientific and imposing an anthropomorphic view upon nature. Modern science tends to see nature instead as dominated by physical and mechanistic principles whose sphere should be clearly distinguished from human society which is a space for free will and action. Recent developments in natural science, however, suggest that there is much more physical and biological continuity and interconnection between humans and nature than we have assumed. In this context, it is necessary that we re-establish our relationships with nature by creatively combining advanced technology that allows humans to manipulate forms, functions and energy of nature, and the kind of world view that recognizes the interconnected principle of life between humanosphere, biosphere and geosphere. In this session, we examine case studies from India, Turkey, Ethiopia and to ask the following questions. What kind of possibilities do biospheric perspectives in the local knowledge offer for bettering our relationships with the environment? What kind of potentialities and problems does contemporary technology (both "bio" and otherwise) have for making human-nature relations more congenial to each other? What kind of transformations are taking place at the interfaces of local and global knowledges as regards the relationships between humanosphere, biosphere and geosphere? What possibilities are there for creating local knowledges, institutions and technology that can promote sustainable humanosphere?

A Virus, Democracy, and Sustainable Society: The Experience of Community-based HIV/AIDS Initiatives among the Gurage, Southern Ethiopia

Nishi Makoto

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Abstract

The ideas of democracy and sustainability seem to collide in many respects. HIV/AIDS is one field in which such problems have become evident. We assume that our societies will be more sustainable if we are able to eliminate the virus. However, our societies will be more democratic if we consider that those living with the virus are an essential part of us.

In this paper, I describe community-based HIV/AIDS initiatives promoted by different stakeholders in the Gurage Zone of southern Ethiopia. One such initiative is a pre-marriage testing campaign that was supposed to prevent transmission from young males who migrate to urban centers in search of job opportunities. Another initiative described in this paper is the “plow your neighbor’s garden” campaign, which requires community members to provide free labor for households affected by HIV/AIDS. Currently, debates are underway locally regarding the relevance of these initiatives.

Based on the experience of the Gurage, I discuss some important aspects of HIV/AIDS initiatives that lead to a sustainable and democratic society in the face of the epidemic. I propose the affirmation of discordance as the key idea. The active involvement of community members in promoting universal testing and supporting households affected by HIV/AIDS are among the key practices that lead to the affirmation of discordance.

To "live with" Earthquakes: An attempt to build a better relationship between the Humanosphere and the Geosphere in Istanbul, Turkey

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Abstract

In the modern world the reexamination of the worsening relationship between the Humanosphere and the Geosphere is a major concern. In Turkey, the Marmara Earthquake that hit the northwestern part of the country in 1999 provided an opportunity to reflect on the relationship. I will develop an alternative perspective of the relationship by examining the consequences of the disaster. In Istanbul, the biggest city in the country, the attention to the Geosphere was increased following the catastrophe. Although quite a few people perceived the earthquake in an Islamic way, they tried to make their understanding of the mechanisms of the Geosphere, uniting scientific knowledge transmitted through the media and information released by the local government (hazard maps etc.). Of course this was not an abrupt change but partly a result of slow "crustal movements" surrounding contemporary Istanbul. People recognized Istanbul's vulnerability to future earthquake and followed scientists' call: To learn to "live with" earthquakes. They attempted to develop their own logic and practices as a hybrid of science, religion, and traditional values. Although their struggles to cope with the risk were confronted with problems and were also followed by backlash, they suggest us the direction we head. Here a better relationship between the Humanosphere and the Geosphere could be observed.

Rice and people; mechanistic and organic visions on biosphere and humansphere

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Abstract

During the 1960s new ideas about ecology, crop production and plant breeding emerged. These ideas are rooted in a 'systems approach' to the biosphere. The approach gained ground in various institutes and services because it resonates with ideas of control and management among political leaders and administrators. In this paper we show how this cybernetic or mechanistic idea of ecology affected crop improvement, in particular the Green Revolution in rice. Critics of the Green Revolution have always rejected the top-down implementation of improved crop varieties and argued for local solutions. Proponents of a local approach generally base their arguments on political grounds, proposing participatory approaches as a way to enhance democratic principles. However, ecological implications of such local approaches are often termed in similar control and management language, emphasizing resource conservation measures and formulating restrictive norms to enhance sustainability. Recent research in West Africa on regional patterns and adaptation of rice varieties suggests that West-African rice farming, hardly affected by the Green Revolution, proves to be a dynamic and flexible activity where local and global influences each find their way. Results suggest that organic forms of interaction between human activities and agro-ecological processes are progressively innovative. This has implications for the perspective on ecological systems in general and rice improvement in particular at the level of global research centers.

Towards political ecology of Life?

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Abstract

Human beings are exhausting their own basis for existence. It is urgent that we establish a sustainable humanosphere in order to survive. By "humanosphere" I refer to human beings and their environment. To make human life sustainable, it is obviously not enough to just think about human beings and we must take into consideration the socio-ecological environment that supports human life. In India, there is a worldview on the biomoral connectedness between humans, land, food, ancestors and deities. Such sensitivity on the connectedness of life should be seen as cultural resources, instead of mere relativistic belief, for introducing biospheric perspective for sustainable humanosphere. I put forward the idea of "democracy of all beings" to suggest that we recognize the agency of unique and plural beings in the world and extend the principle of democracy to apply not only to humans but also to the world of sentient and insentient beings. Democracy of all beings based on political ecology of life takes into consideration the global connectedness of life and tries to respect and guarantee the agency of all beings -- human beings and other sentient and insentient beings -- that are singularly unique and ontologically equal.

Evaluation of Biomass Production of Plantation Forest in Tropical Area

A Case Study of Acacia Plantation Forest, P.T. Musi Hutan Persada, Indonesia

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This paper discusses on dynamic analysis of tree growth and biomass production of Acacia plantation forest in South Sumatra, Indonesia. The data used in this study came from permanent plots established in the operational plantations of *A. mangium* managed by PT. Musi Hutan Persada (MHP) at Unit V in Subanjeriji area, South Sumatra, Indonesia. The analyses were based on the long-term inventory data of planted stands from 2000-2005 that recorded from 2001 to 2006 (1-6 years old). The effects of block area, stand age, and the correlation among tree growth parameters were evaluated. Annual increment was calculated and its relation with annual rainfall was discussed.

The standing tree volume was not significantly affected by the block area at Unit V, as well as the diameter at breast height (dbh) and tree height. However, those parameters increased significantly with plantation age. In rotation of 6 years, the height and dbh of 1-year-old acacia forest ranged from 2.2 to 6.7 m and from 2.5 cm to 7.4 cm, respectively. After 5 years of planting, the height and dbh of acacia trees ranged from 12.8 to 21.1 m and from 13.3 cm to 19.9 cm, respectively. The average stand volume of acacia recorded in 5-year-old stand was 188 m³/ha. The biomass of standing tree at 5 years of age could be estimated at around 94 Mg/ha, with the estimated carbon content of forest biomass was about 72 Mg C/ha.

It seemed that there was any correlation between annual rainfall and annual tree growth, especially in the early stages. However, there were no statistically significant annual increment patterns in this research. Therefore, it should be continuously conducted the assessment of C dynamics associated with the expansion of the time scale and location.

Estimation of Planted Tree Growth using Ground-based Observation and Satellite Remote Sensing Data

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Tropical forests have extreme potentials as environmental resources. These include forest products, rich ecosystems, genetic biodiversity and countless biosphere services. However, most of the natural forests in the tropics are nowadays deeply threatened by human activities from outside. For about three decades, UNESCO has been promoting its Man and Biosphere (MAB) Programme, for sustainable use and conservation of biosphere resources by humans, who are themselves part of the global biosphere. Forests planting positively contributes to MAB activities: it provides timber or pulp searched for their great economic values, as well as invaluable biosphere services such as CO₂ absorption, stable soils, clean water and many other ecosystem amenities. In this research, we aim at monitoring the growth of planted trees in Indonesia, and at estimating their biomass parameters using rigorous on-site surveys, satellite remote sensing techniques (optical and microwaves) and GIS (Geographic Information Systems).

Tropical weather conditions (atmospheric water vapor and clouds) seriously affect the acquisition of high quality optical satellite data, even though optical remote sensing imageries provide us with easily comprehensible image information. Therefore, using microwave satellite data, which are less affected by atmospheric conditions, will provide a powerful source of the spatial information. In this research, GIS-based algorithms for a combined use of passive (optical) and active (microwave) satellite remote sensing data will be developed and applied in order to monitor the planted trees growth and estimate their biomass parameters for sound planning and decision making. Ultimately, the analysis results of this research will provide us with fundamental and critical information to be the base of sound decision-making for sustainable forest management in the tropics.

Addressing The Food-Biofuel Dilemma; using *Paraserianthes falcataria* as A Bioethanol Feedstock in An Integrated Cropping Approach

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The Indonesian Government has set ambitious targets for utilizing its extensive natural resource base for the development of bio-fuels. It views bio-fuels as one of the strategic opportunities at its disposal to regain balance in its domestic energy supply, as well as a potentially high-profit export product for the country. To date bio-fuel development in Indonesia is based primarily on the utilization of food crops.

The aim of 2nd generation bio-fuels is in addressing the food vs. energy dilemma associated with current bio-fuels. However, 2nd generation bio-fuels do not by definition eliminate conflicting interest in natural resource management and have the potential of adding to existing problems associated with industrial plantation development and industries. This paper suggest that in the development of 2nd generation bio-fuels in Indonesia, socio-economic and ecological circumstances should be given similar consideration to economic, production technological and feedstock availability factors when assessing the sustainability of bio-fuel production.

For Indonesia, it may prove worthwhile to return to existing agro-forestry practices such as mixed species gardens and mixed species plantations to identify species that can be used in the production of sustainable bio-fuels. The basic premise is that the chosen species are capable of being sustainably integrated with a variety of other species and crops, being able to cultivate species for both food and energy purposes on a single plot of land.

Paraserianthes falcataria or sengon has been tentatively identified as having the ecological and socio-economic characteristics to potentially fulfill these requirements. It is a common choice in mixed species cultivation systems in Indonesia, and is increasingly associated with reforestation projects. Initial results on the technological potential to develop timber based bio-ethanol from sengon appear equally positive. Using sengon, an initial model for the development of sustainable timber based bio-ethanol production in Indonesia has been constructed.

Loosening Xyloglucan for The Enzymatic Degradation of Cellulose in Wood

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Ethanol produced from crop plants has become a major supplement to fossil fuels for transportation. However, current industrial raw materials for bioethanol compete with food. Therefore, lignocellulose is considered to be an important potential feedstock because cellulose is the most abundant organic compound on earth. Furthermore, the use of plant cell walls as a major energy resource could help mitigate global warming problems since the walls constitute natural CO₂ sinks. However, they are very resistant to enzymatic degradation and thus difficult to degrade into fermentable sugars. It is now necessary to achieve a transformational modification of wood which will enable its use not only as a material but also as a source of glucose through genetic engineering techniques that lead to an increase in polysaccharide digestion.

In order to create trees in which cellulose can be enzymatically hydrolyzed for complete saccharification, we examined several transgenic poplars, each overexpressing xyloglucanase, cellulase, xylanase, or galactanase. The level of cellulose degradation achieved by a cellulase preparation was markedly greater in the xylem overexpressing xyloglucanase and greater in the xylems overexpressing xylanase or cellulase than in the xylem of the wild-type plant. Although a high degree of degradation occurred in all xylems at all loci, the crystalline region of the cellulose microfibrils was highly degraded in the xylem overexpressing xyloglucanase. Since the complex between microfibrils and xyloglucans may be a region that is particularly resistant to cellulose degradation, loosening xyloglucan may facilitate the enzymatic hydrolysis of cellulose in wood.

Molecular Breeding of Tropical *Acacia*

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Forest biomass or lignocellulosic biomass, which is the most abundantly accumulated biomass, may be utilized as an alternative carbon resource to fossil resources. Therefore the tree breeding which enables the sustainable production and utilization of forest biomass is critically important.

Molecular breeding based on the genetic information and transformation technology has been expected in the field of the tree improvement, because molecular breeding can confer the superior traits to the trees in a short period, which is very efficient for the breeding of trees with a long lifecycle.

Generally, in order to proceed the tree biotechnology, it is necessary for us to have the efficient genetic transformation/regeneration system, the database of the genome or transcript (expressed gene) sequences, and the characterized genes in model plant species in hand. Although tropical *Acacia* is one of the most important tropical plantation trees in Southeast Asian countries, its biotechnology is still at a primitive stage.

In this context, first, we are attempting to establish protocols of genetic transformation/regeneration of *Acacia mangium* and *A. crassicarpa*. Second, we are constructing a database of transcript sequences of *A. mangium*. Third, we are characterizing the genes involved in the lignification and production of antifungal heartwood extractives in model species to improve *Acacia*. We will outline the on-going research in the poster session.

Development of Pretreatment System for Enzymatic Saccharification of Japanese Cedar Wood by Wet-Grinding Bench Plant

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Energy supply in Japan mostly depends on fossil fuels imported from foreign countries. We have experienced oil crises two times and recognized that our life entirely depended on the stable import of crude oil at low cost. We have also recognized that mass consumption of fossil fuels caused rapid increase in carbon dioxide concentration in the atmosphere, leading to global warming. These backgrounds urged us to develop bioethanol production systems from lignocellulosics which is not competitive to food supply.

Akita Prefecture is famous for the production of Japanese cedar wood. We have started a project on bioethanol production from Japanese cedar wood as a grant research “The Regional Innovation Creating Research and Development Business” sponsored by the Ministry of Economy. In this project we studied a pretreatment system for enzymatic saccharification using a wet-grinding bench plant, in collaboration with Yamani Co., Ltd., Shimizu Co., Ltd., Sanei Kikai Co., Ltd., Asahi Research Center Co., Ltd., The Akita Center To Implement vigorous Enterprises, etc. The bench plant is constructed at Kosaka town in Akita prefecture. This plant is composed of sawing machine, blender and two disk-grinders for rough and fine grinding. The pretreatment effect was evaluated in terms of enzymatic saccharification ratio, energy cost, processing speed, and particle size distribution. Electron microscopy was used to analyze the grinding effect. It is important to optimize the condition for pretreatments. The cost of original wood, mill construction, processing and transportation is the limiting factor for industrialization in Japan. Because the bioethanol plant using wet-grinding can be placed in rural area near forestry, we hope that this study contributes to the establishment of sustainable society linked with activation of forestry and local economy.

Technology of Biodiesel Production in China

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Currently, energy consumption in China accounts for 13.6% of the total worldwide energy consumption. However, in terms of average resources consumed per person, the consumption in China is still in low level. China has abundant biomass resources. With the issuance of renewable energy regulations in China, the percentage of renewable energy consumption is expected to increase from 7% at present to 15% in 2020. Up to now, one of the most feasible bio-fuels for vehicles is biodiesel. Biodiesel, as an alternative diesel fuel, is made from renewable fats and oils, such as rice bran oil, rape oil, cottonseed oil and animal fat. In 2004, 46.26 million tons of main food oil plants (including soybean, rapeseed, peanut, and sesame) were produced in China, while the consumption was only 24 million tons. The consumption per person is close to 19 kg/person/year, higher than the world average of 2 kg/person/year. Because the edible oil market has become saturated, many companies are focusing on the production of biodiesel from vegetable oils. In addition, a large amount of wasted food oil can be collected from restaurants. Production of biodiesel from the wasted food oil has become a major issue to reduce environmental pollution and also to secure the fuel production. In recent years, the biodiesel industry has been mainly founded by private enterprises. Some production lines with 10,000-20,000 tons/year production, have been built by companies in many provinces. Although the raw materials are available from a wide variety of resources, only inexpensive raw feedstock is applicable to the production of biodiesel in China. In 2006, the price of crude oil raised, resulting in vegetable oil prices were competitive to that of diesel, pushing commercialization of bio-fuels. In recent studies, biodiesel fuels were produced from various resources at relatively raw cost with different technologies. Biodiesel can be produced either with or without catalyst. In the catalyst-assisted biodiesel production system, base, acid or enzymes can be used. Alkali-catalyzed transesterification is currently used in the commercial production of biodiesel. With base as catalyst, waste liquids containing free fatty acids, glycerol and water are difficult to be reutilized. Therefore, great efforts have been directed toward the development of environmental friendly catalysts. Acid transesterification is an efficient method to produce biodiesel if the raw material oil has relative high free fatty acids content. The main disadvantage of enzyme system is that the cost is still prohibitively

high due to generally poor reusability as a result of poor stability of the enzyme. Supercritical technology is a suitable alternative for biodiesel production from a technical and environmental point of view. Supercritical fluid can react with refined oils efficiently without the help of catalyst to produce biodiesel at a high yield (95% to 98%) in a short time. In addition, the effects of biomass fuels on the engine performance, economy, combustion characteristics, and emission characteristics have been extensively investigated.

Energy Development in East Kalimantan, Indonesia

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East Kalimantan in Indonesia is a huge provider of coal, oil and natural gas, but production of oil in this region is gradually decreasing and expected to be depleted in the next few decades. Therefore Indonesian government stated that production of coal is the major target for energy supply in this country. However, strip mining of coal causes serious and extensive environmental destruction in the forest area. The forest destruction exposes dry coal surfaces and causes fire accidents. The consumption of coal increases carbon dioxide concentration in the atmosphere at higher speed than oil, accelerating the global warming. In energy industry in East Kalimantan, it has also been pointed out that the economical profit from coal and oil production is shared with big companies and central government. Much less benefit is distributed to the local people and economy. The Indonesian and local government promotes to reforest or to make plantation of *Acacia mangium*, *Paraserianthes falcataria*, *Elaeis* sp. (oil palm) and many kinds of fruit trees. Especially, plantation of oil palm and fruit trees has been extensively developed in a large scale in this region. *Jatropha curcas* is attractive for biodiesel production and planted at Kutai, Berau and other districts in East Kalimantan. However, the scale of plantation in East Kalimantan is still much smaller than those found in Java Island. Production of bioethanol from wood and other lignocellulosics are not commercialized in this district, but it is one of the potential targets to replace the coal mining in East Kalimantan. Actually the local people hope that the wood resources should be utilized for various purposes not only for wood and pulp supply but also for the biofuel production. In the biofuel industry, it is the most important to secure the natural environment and to activate local economy.

Current Status of Biofuels Policy and Their Technological Development in India

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Biomass contributes over a third of primary energy in India. It delivers most energy for the domestic use (rural - 90% and urban - 40%) in India. In view of the ever increasing demand for fossil fuels due to rapid economy growth, India is integrating alternative fuels in its energy infrastructure. As a result biofuels sector is poised for a rapid growth in India. Currently, Indian biofuels sector is in nascent stage therefore a huge opportunity exists in terms policy involvement unify all existing resources and thereby threading all the elements of the entire biofuels value chain to leverage the maximum benefit and ensuring the inclusive growth of the sector. India planned to develop a strong domestic biofuels industry by increasing investments in recent years. At present, a major focus has been placed on Jatropha plant seeds which contain 40% of oil and grow well in dry marginal non-agricultural lands, thereby allowing rural and forest communities to leverage non-farm land for income generation. Moreover no food producing farmland is required for producing this biofuel (unlike corn or sugar cane ethanol, or palm oil diesel); it is considered the most politically and morally acceptable choice among India's current biofuel options. It also has positive environmental social and economic advantages; including low green house gases emissions. The government has also implemented an ethanol-blending program and considering initiatives in the form of mandates for biodiesel. Due to these strategies, the rising population, and the growing energy demand from the transport sector, biofuels can be assured of a significant market in India.

The Role of Remnant Forest in Conserving Bird Diversity in Acacia Plantation in Indonesia.

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The impact of decreasing ecosystem services in tropical rain forest is habitat loss. Maintaining biodiversity requires adequate landscape structure or management procedure. In South-east Asia, large-scale plantation as *Acacia mangium*, Oil palm, and rubber already spread over land, and it could be one of the reasons of habitat loss, since usually one tree species is planted. Our objective is to clarify the bird species diversity differences in *Acacia mangium* plantation and conserved secondary forests. We then aim to propose an adequate landscape structure to maintain avifauna original to that region. Our study site is located in 260,000 ha Acacia plantation in PT. Musi Hutan Persada, South Sumatra, Indonesia. We conducted bird survey in the conserved secondary forest and in several Acacia plantation sites with different distance (0.5km, 1-2km, 6-7km, 10-15km) from the nearest conserved secondary forest. Similar survey was conducted at Acacia plantation with different age (0-1 year, 4-5 year) in the same distance from conserved secondary forest.

Three methods were used for bird survey. (1) Point-count method; we recorded species during ten minutes' standing at the point, and count number of individuals within 25m radius. (2) Bird calls recording, whenever possible we used IC-recorder during point-count to record bird calls for the later identification. (3) Infrared rays camera; throughout our stay, we set 4 automatic cameras with infrared rays sensor at the height of 1~2m.

From point-count census, we have observed 32 bird species in young acacia plantation, 36 species in mature Acacia plantation, and 55 species in conserved secondary forest. Significant differences in avifauna were observed between Acacia plantation and conserved secondary forest, and declining number of species were indicated according to the distance from the conserved secondary forest. But in some point, relatively high species number is observed in young Acacia plantation, since we counted birds in the remnant forest which is close to Acacia plantation. The remnant forest spreads widely in the region, probably being a good habitat for birds.

Spatial-Temporal Variabilities of Nitrous Oxide Emission from *Acacia mangium* Soils

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We compared spatial structures of N₂O fluxes in an *Acacia mangium* plantation stand in Sumatra, Indonesia between dry (August) and wet (March) seasons. A 60 × 100 m plot was established in an *A. mangium* plantation that included different topographical elements of the upper plateau, slope and valley bottom. The plot was divided into 10 × 10 m grids. The N₂O fluxes and soil properties were measured at 77 grid points of 10 m intervals in the plot. Spatial structure of the gas fluxes and soil properties were identified using geostatistical analysis. The means (± SD) of N₂O fluxes in a wet season, 1.85 (± 1.18) mg N m⁻² d⁻¹, were significantly higher than that in a dry season, 0.55 (± 0.42) mg N m⁻² d⁻¹. This seasonal fluctuation of N₂O fluxes suggests that *A. mangium* soils function as a larger source of N₂O than natural forest soils on Sumatra. Spatial structure of N₂O fluxes in a wet season was considered to be mainly governed by that of water-filled pore space (WFPS), while that in a dry season seemed to be controlled by spatial patterns of soil resources distribution. In *A. mangium* stand soils, we suggest that the factors controlling spatial structure of N₂O fluxes are different between wet and dry season because of seasonal changes of both WFPS and fresh substrate supply into the soils.

Keywords: *Acacia mangium*, fast wood plantation, nitrous oxide, seasonal change, spatial structure

Land Surface Monitoring in The Kyzyl Kum Desert, Central Asia

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Overcoming regional water problems requires an understanding of both natural hydrological conditions and social and historical changes in regional water policy. Central Asian nations face serious water problems, and we here review the circumstances surrounding water resources in the Syr Darya and Amu Darya River basins in terms of water management changes and climatic trends. Two major rivers – the Syr Darya and the Amu Darya – originally flowed into the Aral Sea, once an inland lake that was the world's fourth largest in water area. In the 1960s, the Soviet Union started large-scale irrigation projects in the vast dry steppes extending through the mid and downstream basins of these two rivers. By 1999, irrigated farmland occupied 7.90 million ha and water taken from the rivers ranged from 110 to 117 km³. The main crops promoted were water-consuming – cotton, rice, wheat, maize, and grass. The huge increase in water diverted to irrigated areas dramatically decreased water flowing into the Aral Sea, disturbing the balance between water inflow and evaporation from the lake, drastically reducing the lake area and rapidly raising the saline concentration from 10% to 35%. The Aral Sea became divided into the Small Aral in the north and the Large Aral in the south, both of which continue to shrink.

The Kyzyl kum desert is located in the flatland between the rivers Amu Darya and Syr Darya. It is a typical desert area and has unique climate condition and ecosystems. There are small oases in this area and local people use them for crop irrigation. To understand the hydrological cycle is important for local people and sustainable farming, however there are not enough data for scientific analysis. Moreover, air temperature is increasing about 0.9-1.0 degree for 100 years and 0.4-0.5 degree for 25 years in Uzbekistan which is relatively higher than global averages. The object of this study is to understand the hydrological and ecological systems in this region including climate variation and change. We started the land surface observation since November 2006 in Kyzyk ke sek. Additionally, landcover and vegetation mapping using satellite remote sensing data are analyzed for large scale modeling.

**Resilience, Vulnerability and Regime Shifts:
Metamorphoses of A High Biomass Society in Sarawak, Malaysia.**

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The equatorial zone has accumulated the highest concentration of biomass in the biosphere due to greater insolation and heavier rainfall. The region has also been the most fertile ground for natural resource utilization from the age of commerce to industrial capitalism. No other climate or vegetation zone competes with the tropics in terms of plant density and regeneration pace. Such a tropical zone with several hundred million years of history has gone through fast-paced metamorphoses in the past several decades and changing status of the biomass.

This presentation looks into the resilience and a regime shift of a high biomass society in Southeast Asia, by looking into the case of a riverine community of northern Sarawak, Malaysia, over the past 140 years. It is concerned with the transformation of a forest dwelling society with its encounter with the maritime mercantilism and terrestrial capitalism, both colonial and post-colonial. The historical development of global commodity chains, newly established symbiosis between plywood and plantation industries, forms of labor mobilization, and their relations to local communities are issues at stake.

Protecting Forest, Empowering Communities: Development of Community Forestry Policy in Decentralizing Indonesia

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Forest in Indonesia has been seriously depleted, and social conflicts over the forest resources have occurred in many places because of the state-based centralized policies that neglected the role of local people living in and around “forest area.” Community forestry policy introduced by the central government in 1998 is a breakthrough to such a situation. The policy clearly stipulates that local people should be a principle actor in forest management. In order to make local people as a capable and responsible actor in this policy implementation, it is necessary for government officials concerned to facilitate local people to establish their own rules and strategies for managing forest in accordance with social context and ecological settings.

This presentation takes the case of Sumber Agung Village, Lampung Province, Sumatra, a pioneering village that obtained five-year permission of community forestry in 1998, which recognized the villagers’ use of the forest area. The research was conducted in order to examine the impacts of policy implementation by focusing on the aspects of community empowerment and forest protection. The case of Sumber Agung Village shows that both the development of effective local institutions and the legal recognition of their access to the forest are inevitable for realizing successful and sustainable community-based forest management.

Recent Collaborative Researches for Developing Earthquake Resisting Wooden Residential Houses with Tropical Fast Growing Timbers

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Since about ten years ago, we have been continuing collaborative researches, in the field of forest products for utilizing forest resources brought from tropical forest, by cooperating with researchers in Indonesia or/and Malaysia under the support called as “Core-University Program” approved by Japan Society for Promoting Science. After finishing this governmental research program, our collaborative research has been focused on the development of earthquake resisting wooden residential houses by using tropical fast growing timbers, probably due to the reason that in both Indonesia and Japan a series of devastating earthquakes happened and both countries suffered huge amount of damages both in human lives and their properties. Now in these countries, how to insure the anxious-free and safety on people’s living shelters (residential houses) against anticipating huge earthquakes is one of the most emergent issues to be resolved. Based on these backgrounds, we have started small-scale collaborative research projects using our individual research budget for developing earthquake resisting wooden residential houses or their structural components made of tropical fast growing timbers or engineered wood products.

In this conference, we will introduce some research results on a poster having titles such as; “Development of structural LVL from tropical wood and evaluation of their performance for the structural components of wooden houses part-1 Application of tropical LVL to a roof truss”, “Shear wall made of rubber wood and falcatalia mixed species LVL easily built-up with power driven coarse-thread screws”, or/and “Anti-seismic wooden houses made of wood from man made forest” and so on.