Hokkaido University International Symposium on Sustainable Development
Plenary Session 4: Monday August 7, 2006 / 4:20pm-6:00pm

Summary of Plenary Session 4: Sustainability Governance on Food and Bio-resources

Chaired by **Yutaka Saito**

Deputy-Director
Sustainability Governance Project (SGP),
Hokkaido University
E-mail: yutsat@res.agr.hokudai.ac.jp

Speakers:
Teisuke Miura, Professor, Graduate School of Fisheries Sciences, Hokkaido University
Nasir El Bassam, Director, International Research Centre for Renewable Energy (IFEED), Germany
Mitsuru Osaki, Director, Sustainability Governance Project (SGP), Hokkaido University

Can we maintain our present lifestyles for the next 50-100 years to come? What will become of our resources, food and environment if society continues its present practices of mass production, mass consumption and mass disposal? These are very important questions for people living in the 21st century. In this section, three researchers who have studied on the sustainability of fisheries and agriculture were invited to review the present state of these fields.

The first speaker, Prof. Teisuke Miura addressed several current problems facing fisheries in Japan. He accessed the amount of fish imported into Japan from many countries and discussed how we must focus more attention on conserving the fisheries resources of exporting countries. Furthermore, the shrimp culturing that has resulted from strong Japanese demand has lead to poverty and the coastal destruction of many South East Asian countries. He proposed that by making the fisheries industry more sustainable, such problems could be resolved. To do this however, education systems must adapt, namely we need to provide foreign students not only with technology, but also with the philosophy of sustainability.

The second speaker, Prof. N. El Bassam addressed the necessity of new bio-resource industries as a strategy that can meet the needs of the present without compromising the ability of future generations to achieve their own requirements. He said that primary energy sources are limited and mainly non-renewable and not sustainable. Furthermore, the world,

primarily developing countries, is facing a period of uncertainty and change - depopulation of rural regions and decreasing farmer incomes. Thus, he concluded it is our responsibility to foster public education and outreach programs to promote awareness of ecological, biological and organic production systems at all levels of society.

The last speaker, Prof. Mitsuru Osaki discussed the importance of carbon storage in soils, and outlined the seriousness of wild fires in the peat lands of South-east Asia and Siberia. Furthermore, he advocated the importance of the soil rhizosphere for sustainable agriculture, and how further researches in this field will advance safe agriculture without the need for chemical fertilizers. In addition, he introduced the purpose of the Hokkaido University Sustainability Governance Project and Global Land Project, both of which were established to create "sustainability sciences".

Hokkaido University International Symposium on Sustainable Development
Wednesday August 9, 2006 / 9:00am-9:30am
Keynote Speaker

Education for Sustainable Development: If Not the Solution, At Least a Start

Sheldon Shaeffer

Director
UNESCO Asia and Pacific Regional Bureau for Education, Bangkok, Thailand
E-mail: s.shaeffer@unescobkk.org

−Prof. Kishinami, Chairperson−

Good morning ladies and gentlemen. I'd like to call the morning session to order. The title of this session is the Role of Higher Education and International Collaboration for Sustainable Development. My name is Kishinami, the chairman of this session. Let me introduce to you Professor Yamagishi who is the co-chairman of this session, and she is a professor at the Centre of Research and Development in Higher Education at Hokkaido University. We'll be responsible for this session, and would like to ask you for your kind cooperation. According to the program today, let me introduce to you Dr. Sheldon Shaeffer, who's a Director of the UNESCO Asia and Pacific Regional Bureau for Education. His keynote speech is entitled "Education for Sustainable Development: If Not the Solution, At Least a Start". Dr. Shaeffer studied history and international development education at Stanford University. He has a B.A. in history, an M.A. in anthropology, and a Ph.D. in international development education. After working in several positions in education, he started to work for international organizations in 1980, including the International Development Research Center in Ottawa and UNICEF Headquarters in New York, and has been assigned to the current position in UNESCO since 2001. As you know, UNESCO is a leading organization among the United Nations institutions for education for sustainable development. Dr. Shaeffer's responsibility covers not only the education for sustainable development, but also educational and cultural activities of UNESCO in 45 countries and regions in the Asia Pacific. Dr. Shaeffer, Please.

−Dr. Sheldon Shaeffer−

Ladies and gentlemen, I'm very happy to be here today. I'd especially like to thank Prof. Kishinami and Prof. Yamagishi for chairing this session this morning. Also my thanks to Prof. Hondoh, who invited me to come here, and has the wonderful title of Global Manager of this initiative at this university, and last but not least, Prof. Tambo and the colleagues on

this panel. My task this morning is to review for you the initiative in terms of education for sustainable development, especially focusing on a UN initiative, which is the Decade of Education for Sustainable Development. As was said in the introduction, I am Director of the UNESCO Asia and Pacific Regional Bureau for Education, which is in Bangkok and covers 45 countries across Asia and the Pacific, in the areas of education, culture, social science, and communication. I noticed, looking through the titles of the papers and some of the abstracts, that there was a considerable focus on issues relating to population, food security, water, energy, disease, climate change, and many of the other issues that we have to face when we think about what is going to happen in terms of our future. We at UNESCO are also interested in another kind of statistic, which I'd like to talk about now.

Linguists around the world generally estimate now that there are something like 6,000 languages currently spoken in the world. The estimate is that, given the current rate of language death, by 2050 there will only be about 600 left. About 10% of the languages as we know them now will be left in another 45-or-so years. And of course, with language go history, tradition and culture. We think this kind of threat to languages and cultures is something that also has to be considered very seriously when one is looking at this question of what a sustainable future looks like.

What I'd like to do here is to go through what is generally seen to be the standard definition, going back to the Brundtland Report on the World Commission on Environment and Development of 1987, that "sustainable development is development that can meet the needs of the present without compromising the ability of future generations to meet their own needs". Sustainable development therefore requires this very difficult balancing of environmental, societal, and economic considerations in the pursuit of development, and also an improved quality of life, again, not only for this generation but for future ones. However, it also tries to promote not only the ideals of environmental preservation - for example, environmental restoration, and poverty alleviation - but also a wider range of issues which be considered in trying to guarantee a sustainable future, includes such as issues of gender equity, just and peaceful societies, human rights and cultural diversity. So the idea is that sustainable development has to start with the immediate and pressing environmental and economic issues that face us now and will face us in the future, but also has to look at a much wider range of issues.

Education for sustainable development tries to use a partnership approach. It engages multiple sectors, not only scientists, economists and others who might be interested in an academic sense, but also many others, including media and, of course, the private sector. An issue to me when looking at a workshop or at a conference like this, with an audience like this, is how many representatives of the media and of the private sector have also been included or involved. It tries to use this partnership approach and tries to utilize all forms and methods of public awareness raising, education, and training. It's not only an issue of the formal school system, but of many other kinds of non-formal and informal education. It tries to encourage people to understand the complexities of, but also the synergies between,

the issues that threaten sustainability in the future, and also asks people to try to understand their own values and those of the society in which they live. It's trying to say to people that problems exist, and that we are part of those problems; we are involved in those problems, and we have to examine not only our knowledge and our skills but also our values in relation to what can be done in the future.

If one looks at what education for sustainable development is trying to do, it's really focusing on a learning process, not only the teaching of the facts themselves, but learning that tries to focus on such things as reforming the structure and nature of basic education; to what extent and how should the content of education and the methods change to try to ensure that the students and the learners and the system can understand these issues better. It tries to reorient existing education programs, trying to improve them and reorient them towards more developmental-oriented issues; it tries to develop public awareness about what sustainability actually means, and it tries to build capacity not only within education systems, but also in all of ESD partners.

According to the nature of education for sustainable development - as it has been defined not only in the Johannesburg conference of several years ago, but also in subsequent discussions at the United Nations about the Decade of Education for Sustainable Development - there are considered to be three pillars. There's a pillar of society: an understanding of the social institutions - governments, schools, families, communities, religious organizations - and of their roles in change and in development. Of course, an important pillar is the environment - an awareness of the natural resources that many of you were speaking about yesterday, and also of how fragile the physical environment often can be. There's also an economic component - a sensitivity to the limits but also the potential of economic growth, and the impact of this on society and on the environment. Again, discussions were held on this yesterday. There's also a very important underlying component; a cultural one that really looks at how people behave, what they believe, how they act, which is different in every society one belongs to, as an underlying critical dimension underneath all the important pillars. This is, I'm afraid, something we often don't look at.

When one looks at education for sustainable development, there are many core issues that are reflected in the education programs: conservation of natural resources, climate change, the transformation of rural societies, sustainable urbanization, disaster prevention and mitigation, which has become much more visible and important in this region since the tsunami. There are, of course, economic issues, poverty reduction, the issue of greater corporate responsibility and accountability, and a market economy that is more benign in terms of sustainability than it often has been in the past. Then there are socio-cultural issues again, issues that I think we probably don't look at hard enough or carefully enough in terms of what is necessary for a sustainable future includes fulfilment of human rights, a guarantee of peace and human security, gender equality, good health, good governance of the systems that are in charge of the development process, a greater reinforcement of intercultural and international understanding, and, from our point of view especially, the preservation of

cultural and linguistic difference and diversity.

When we look at education for sustainable development, and try to promote it within education systems across the region, we see it as having a number of different characteristics. It should focus on how to create a more interdisciplinary and holistic approach to the issue. It should be values-driven - knowledge is important, specific skills are important, but underlying it also is an analysis of, and a change of, values. If you look across education systems in the Asia Pacific region now, and look at what the curricula include, you'll see any number of values-based programs - education for international understanding, and global understanding, moral education, peace education, democracy education, citizenship education, life skills education, and many more. What I think we are trying to say is that all of these different kinds of values-based education really have to be seen underneath a larger umbrella or a larger conceptual framework about the values necessary for sustainable development. This kind of education for sustainable development tries to focus on critical thinking, problem solving individually but also collectively. It's multi-methodological in nature; it tries to involve participation in local decision making in the classroom and in the community; and, of course, it tries to be very much relevant to the local environment.

One conclusion of the meeting in Johannesburg, and this was a proposal of the Japanese government at that conference, was to create a UN Decade of Education for Sustainable Development. This was later confirmed in the General Assembly of the United Nations, with UNESCO as a coordinating agency. The vision of the Decade as proclaimed and as agreed to in the General Assembly is to try to lead to a world where everyone has the opportunity to benefit from education and also to learn the values, behaviors, and lifestyles required for a sustainable future, and for positive societal transformation. It's that kind of productive last piece of it that I think is especially important.

The Decade is trying to facilitate networking and linkages, exchanges, and interaction among stakeholders - the kind of thing happening at this meeting - at least among more academic-oriented people. It's trying to foster an increased quality of teaching and learning in general in education systems around the world; it's trying to help countries in this process make progress toward and attain the MDGs through ESD efforts; and it's trying to provide countries with new opportunities to incorporate education for sustainable development into education reform efforts. Many countries in the region and the world periodically undertake education reform activities, curriculum reform, and teacher-training reform activities. The issue is how, at that moment in a country's education development history, one promotes the ideals and the methods of something like education for sustainable development. That, I think, is the important task.

There's a lot of work trying to focus on advocacy - trying to get people in all sectors to understand the issues; consultation and ownership; partnership and networks; capacity-building and training; research; development and innovation; the use of information and communication technology in education for sustainable development; and of course, monitoring and evaluation. As we speak there is another meeting being held elsewhere in Japan, with UNESCO and many other partners including the IUCN, trying to establish what are appropriate indicators to measure whether, in fact, in the course of the Decade and beyond, any progress has been made at all in terms of promoting the ideals of the Decade. Now you can

see here how higher education can fit into these many different kinds of strategies.

There is what is called the International Implementation Scheme for the Decade; there is also an Asia Pacific regional strategy. This is based on a situation analysis done a couple of years ago as to what the state of and the understanding of sustainable development is in the region, but also include a specific strategy for ESD, with a working paper that tries to guide the implementation. It's an open document continuously being revised, and it's trying to focus on collaboration and networking around the core issues, trying to clarify the roles of the different stakeholders - again, the media, private sector, international agencies, civil society organizations, non-government organizations and others. And it's trying to focus on stronger coordination, and monitoring and evaluation mechanisms. This strategy was based on consultation with literally dozens of stakeholders around the region from many different audiences. In this region there is a Regional United Nations Interagency Committee, which is looking at the issue, with members including the United Nations University, the United Nations Environment Program, the Asia Pacific Centre of Education for International Understanding, the Asia/Pacific Cultural Centre for UNESCO in Tokyo and many others, and there's also an Asia Pacific Regional Consultation Group - more of an expert group - that is trying to promote the ideals of the Decade.

If we look at ESD in higher education - things that perhaps could be done - the important issue is how do we try to ensure that issues related to sustainable development are incorporated in all higher education curricula and research agendas? To what extent can we ensure these issues are incorporated not only into faculties of science, especially environmental science, but also in terms of economics, business, journalism, and social and human sciences? The whole range of faculties within a university should have some kind of discussion around these issues, in terms of teaching and in terms of research. We would think it especially important that faculties focusing on teacher education and teacher education institutions, whether it is pre-service or in-service, especially in areas like social science, geography, etc., are focused on issues of sustainability. To what extent are training teachers across the region now being introduced to any of the broad-ranging issues that relate to education for sustainable development? Trying to develop model teacher-training programs and associated materials based on especially innovative ESD activities, showing how the different components - social, economic, environmental and cultural - can be linked, is also important. There are already good models of this. There is a CD-ROM that was developed within UNESCO a couple of years ago that tries to bring together the best of these materials, and of course that has to be continually updated, which is one of the purposes of the work that's now being done. We are trying to look at the best of the models in terms of how ESD can be integrated into classrooms and into schools. That's one thing I think also can be done in terms of higher education. The idea is not to try to establish in every education system in the world a new subject called Education for Sustainable Development, which would, if you were lucky, be one hour a week. The idea, if at all possible, is to try to see how the values related to education for sustainable development can be integrated across the subjects of a school curriculum, including the reorientation of business and journalism schools, and even the establishment of sustainable campuses. I've just read about the National Taiwan Normal University, where a very serious attempt is being made by the university itself in

trying to make its campus environmentally sustainable.

There are other specific programs that can be looked at, and you may have heard of the United Nations University; ESD-focused institutes; Masters and Ph.D. programs in ESD; the UNU post-graduate program at Tongji University, supported by the United Nations Environment Program. This is a leadership program at the Institute of Education for Sustainable Development that tries to take Ministry of Education and other leaders from around the region and put them through a training program looking at some of the research, technical and management skills needed to promote education for sustainable development. This UNU post-graduate education program funds Ph.D. and postdoctoral fellowships, promotes education for sustainable development and the Decade, and includes research and cases studies on Regional Centers of excellence. This program at UNU is a very interesting one. I think the term Regional Centre is a bit of a misnomer; it doesn't quite describe what these are. These are centers found in coherent sub-regions, cities, islands, river valleys and others; they are centers in a particular geographic or demographic logical region which are trying to promote within that region sound sustainable development activities. So these are regional centers of excellence, of which there are many in the region and of which there will be many more. This program is trying to examine factors for success and the development of curricula for priority topics at ESD. So there are increasingly across the region, especially in East Asia, specific dedicated institutes and programs related not only to sustainable development but also in fact, to education for sustainable development.

Finally, I think there are other issues related to interdisciplinary, inter-institutional studies and programs on ESD. The question of longitudinal studies to evaluate the impact of ESD programs is critical-something I think higher education institutions are probably especially appropriate to carry out, along with the further development of conceptual and theoretical frameworks for ESD. There are still a lot of issues as to what it actually is and means and looks like. One view is that it's going to look quite different in every context in different countries in different regions, but trying to understand this better from a conceptual and theoretical point of view is a very important one. Then, of course, it is essential to identify and evaluate the best kind of pedagogy teaching/learning methods for promoting the ideals of education for sustainable development.

There's much more information to be found. We have in UNESCO Bangkok a website on ESD. There is also going to be a large conference in Bangkok at the end of December, looking at education for sustainable development.

Let me close by just saying in the UN system there are probably too many Decades. If you were to see a list, which we get periodically, of all the UN Days and UN Years and UN Decades, it's quite daunting. I would say every week or so out of Paris Headquarters there is some speech or statement by the Director General in commemoration of one or another UN Day, Year or Decade. There are probably too many of them, and they are often too easily adopted by the United Nations. Unfortunately, it's very easy to launch a Decade, that's done

all the time. But it's much more difficult to try to ensure systematic implementation and follow-through in the course of such a long time as a decade. Obviously, the work of trying to promote education for sustainable development is the work of much more than a decade. But we feel that the issues are of great enough importance that, taken much more seriously, this Decade of Education for Sustainable Development is something we simply have to do.

I look forward very much to working with many of you in trying to further the ideals and the goals of this decade. Thank you very much.

—Prof. Kishinami—

Thank you very much for your excellent presentation. Are there any questions or comments?

—Questioner1—

Thank you very much for an excellent presentation. One of the points that you brought up was sustainable development to be incorporated into higher educational curricula and research. There was a decision by the government in Sweden in 2000 that this should happen. Unfortunately, it hasn't happened in the 6 years since the decision, and it hasn't happened for a number of reasons. Probably two of the main reasons are ones you've mentioned in your presentation. One is the dilemma between advocacy and scientific credibility. I think we wrestle with that all of the time, both in the academic community and research community. Where is that balance? If you go too far along the advocacy line, you lose your scientific credibility, and it makes a lot of scientists uncomfortable. The other problem or challenge is at what point can you become multi-disciplinary? Because that's really required for sustainable development, but then you must be firmly founded in some discipline before you branch out, and that's another point of debate. And the limitation for incorporating sustainable development into curricula is that people are unwilling to give up their "disciplinaryness" to become multi-disciplinary. I wonder if you have any comments or advice for the further panel discussion on those issues.

—Dr. Sheldon Shaeffer—

Looking just within the UN system, it's what we're trying to promote, of linkages between, for example, the UN Environmental Program, that would be discussing some of the more scientific issues, a considerably fuzzier agency like my own. Trying to see what is the best way or an appropriate way is to try to assure - if not a marriage - at least a cohabitation of advocacy and scientific pieces. As you say, if one is only promoting advocacy without being firmly based on the experiences locally or globally in terms of what science is telling us, or if scientists are doing their studies out of context of the larger messages that should come out of that scientific knowledge, then I think we are on the wrong track. At least within our own system, both in Bangkok and globally, this kind of linkage between the two worlds is something that we are trying to work for. I think in a program like the United Nations University program and these Regional Centers, more at the grassroots level, that can also be done. I've also been involved with a number of multi-disciplinary initiatives in different places around the world, and they are very difficult, the idea always being that if

you put everyone on the same floor, they'll all talk to each other. Well that doesn't work, even if you leave the doors open. I think that is also going to be very much context specific. I could imagine some institutions that are very strong in terms of environmental issues from a scientific perspective, who should attempt to reach out and bring into that strong base, social, human, cultural and other kinds of issues. I can imagine those centers that are especially strong in terms of some of the ethical issues or the social, historical or cultural issues, wanting to try to bring in as resource people those who represent very different perspectives. I think you are absolutely right. Trying to build something that is multi-disciplinary when the disciplines are not strong in themselves just isn't going to work. I've seen that fail all over the place. I would add one other reason why this example like in Sweden often doesn't work; it's because there isn't this understanding, or as we say "ownership", of the issue at the bottom of the system. There are interesting activities around the region, especially through non-government organizations, which are really starting at the village and the community level; getting villages and communities to reflect on and do their own broadly defined environmental audits to try to see what actually can be done. I think that's where you also have to start. A Decade from the United Nations isn't going to get you very far unless you focus at that grassroots level.

—Prof. Lawrence Mysak—

That was a very nice presentation. My name is Lawrence Mysak from McGill University. I'm an environmental scientist and I spoke on Monday on Long-term Climate Change Past and Future. I noticed from your CV that you spent a number of years in Ottawa working for IDRC and maybe other organizations. I know at that time, in the '80s or '90s, there was an attempt to promote things like sustainable development through bringing together research funding projects that involved both the Social Sciences and Humanities Research Council and the Science Research Council, respectively. I guess my question to you is, of course, putting out dollars often is a way of bringing together people from the two sides, or cultures in C.P. Snow's words. How successful do you think that funding was in the past - and maybe it's still going on today but I've not heard too much about it in recent years?

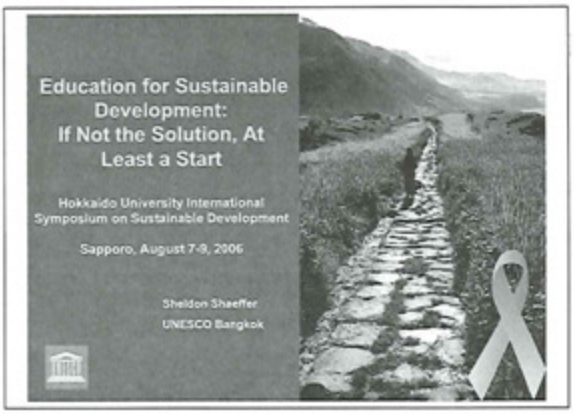
—Dr. Sheldon Shaeffer—

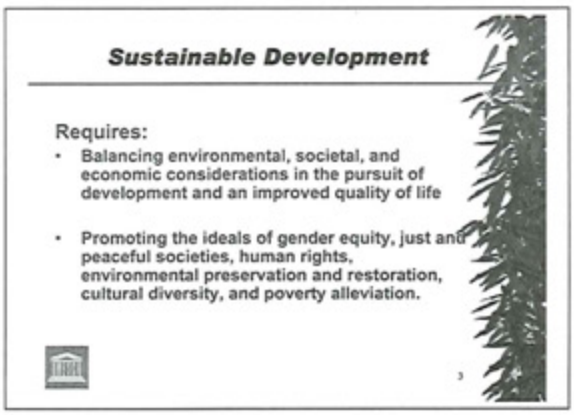
I was in IDRC for about 10 years in the education and population program, and saw those programs rise and fall, if you will. I don't think it was because I was there that it fell, but one might argue differently. There was at the time a very strong science/technology environment program that tried to link-in across the many other sectors. These things, I'm afraid, in bilateral and multilateral agencies, as perhaps in universities, come and go, and they get replaced by other issues such a social policy and governance. I used to work in the Ford Foundation, a strong education program that now has nothing left because other issues seemed to take over and become more important. The interesting thing is if you were to actually go to countries in the developing world that were the venues for the activities funded out of Canada, you'll probably find much more visible residues of the activities than you'll find in Canada itself. In fact I just heard two days ago from a former IDRC colleague that one of the original staff members of that particular very strong unit has been asked by IDRC

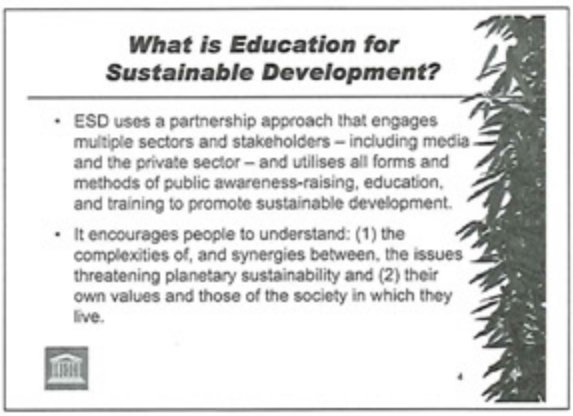
to do an analysis of the history of what happened, in terms of science/technology and energy, with the possibility of reviving or restarting a program. You have to see it as a kind of pendulum, and try to oversee not what are the fads at the higher levels of the system, but what can actually be done at the bottom of the system, in terms of building the institutions. They might in fact last long beyond whatever our activities might be at the international level.

−Prof. Kishinami−

Thank you very much, Dr. Shaeffer.







Domains of Education for Sustainable Development

ESD is about learning rather than teaching and therefore requires:

- Reforming the structure and nature of basic education
- Reorienting existing education programmes
- Developing public awareness about what sustainability means
- Building capacity within education systems and across all other ESD partners

5

Education for Sustainable Development (ESD)

Three Pillars of Sustainable Development

- **Society** – an understanding of social institutions and their role in change and development
- **Environment** – an awareness of natural resources and the fragility of the physical environment
- **Economy** – a sensitivity to the limits and potential of economic growth and its impact on society and on the environment

with **Culture** – ways of behaving, believing, and acting which differ according to context, history and tradition -- as an underlying and critical dimension

6

Core Issues

Environmental Issues

- Conservation of natural resources
- Control of climate change
- Transformation of rural societies and environments
- Sustainable urbanization
- Disaster prevention and mitigation

7

Core Issues

Economic Issues

- Poverty reduction
- Corporate responsibility and accountability
- A "benign" market economy

8

Core Issues

Socio-Cultural Issues

- Fulfillment of human rights
- Guarantee of peace and human security
- Gender equality
- Good health (e.g., HIV/AIDS prevention)
- Good governance
- Reinforcement of intercultural/international understanding
- Preservation of cultural diversity

9

Key Characteristics of ESD

- Interdisciplinary and holistic
- Values-driven
- Focused on critical thinking and problem solving
- Multi-methodological
- Participatory in decision-making
- Locally relevant

10

UN Decade of Education for Sustainable Development (DESD)

VISION

A world where everyone has the opportunity to benefit from education and learn the values, behaviours, and lifestyles required for a sustainable future and for positive societal transformation.

11

UN Decade of Education for Sustainable Development (DESD)

" The UN Decade of Education for Sustainable Development (DESD) is the overarching framework, but, from the outset, we must not confine ourselves to an over-narrow view of what 'education' means in this regard. In effect, it embraces knowledge and how it is shared in a global context where the operative word is 'interdependence' – between humankind and nature; between nations and cultures and between the present and the future."

Koïchiro Matsuura, Director-General of UNESCO
remarks/date: ceremony on 21 October 2005

12

UNESCO'S Role in Implementing DESD

- Building capacity
- Promoting international cooperation
- Leading coordination at the international level
  - Catalyse new partnerships
  - Encourage monitoring and evaluation
  - Encourage research on ESD
  - Bring together important stakeholders
  - Share good ESD practices
- Ensuring intersectoral cooperation within UNESCO

13

International Implementation Scheme (IIS)

Contents:

- Overview of ESD and the Decade
- Goals and objectives of the Decade
- Relation to other international initiatives
- Strategies for implementation
- Roles of stakeholders
- Monitoring and evaluation

14

Objectives of the Decade

- Facilitate networking, linkages, exchanges, and interaction among stakeholders in ESD
- Foster an increased quality of teaching and learning in Education for Sustainable Development
- Help countries make progress toward and attain the Millennium Development Goals (MDGs) through ESD efforts
- Provide countries with new opportunities to incorporate ESD into education reform efforts

15

Strategies for Implementation

- Vision-building and advocacy
- Consultation and ownership
- Partnership and networks
- Capacity-building and training
- Research, development and innovation
- Use of ICTs
- Monitoring and evaluation

16

Asia-Pacific Regional Strategy for ESD

Working Paper

- A guide to ESD implementation in the region
- An open document adaptable for revision
- Focused on collaboration and networking
  - Around the core issues for ESD
  - By clarifying the roles of stakeholders
  - Through stronger coordination, monitoring and evaluation mechanisms
- Based on consultation with different stakeholders

17

DESD in Asia-Pacific

Asia-Pacific Regional UN Interagency Steering Committee

- Coordinates ESD efforts among UN agencies
- Advocates for ESD
- Promotes communication and networking

Asia-Pacific Regional Consultative Group

- Comprises experts representing stakeholder groups/geographic interests
- Promotes research and knowledge exchange
- Activates networks and projects

18

DESD Outcomes: Evidence-based monitoring and assessment frameworks established

- Provide assistance to develop and publish national ESD guidelines
- Support development of M&E processes
  - Set targets for the Decade
  - Divide responsibilities for M&E
  - Ensure appropriate mechanisms for monitoring and reporting
  - Develop a prototype DESD monitoring system

19

ESD and Higher Education

- Sustainable development incorporated in all HE curricula and research agendas
- Reorientation of teacher education (especially in terms of social science, science, geography, etc.) towards issues of sustainability
- ESD model teacher training programmes and associated classroom and teacher training materials based on innovative ESD curricula and showing linkages among ESD components
- Reorientation of other higher education institutions, e.g., business and journalism schools
- Establishment of "sustainable" campuses; e.g., National Taiwan Normal University

20

ESD and Higher Education

- ESD institutes and Master's and Ph.D. programmes (e.g., United Nations University postgraduate programme, UNEP-Tongji Leadership Programme)
- United Nations University postgraduate education programme in Education for Sustainable Development
  - funds Ph.D. and postdoctoral fellowships
  - promotes Education for Sustainable Development and the Decade of ESD
  - includes research and cases studies on Regional Centers of Excellence for ESD
  - examines factors for success and the development of curricula for priority topics for ESD

21

ESD and Higher Education: Research and Development

- Inter-disciplinary, inter-institutional studies and programmes on ESD
- Longitudinal studies to evaluate the impact of ESD programmes
- Development of conceptual and theoretical frameworks for ESD
- Identification and evaluation of appropriate ESD pedagogy

22

For more information on ESD in the Asia-Pacific region:

Visit our website

www.unescobkk.org/esd

Or email us

esd@unescobkk.org

Or attend our conference

- "Learning Together for Tomorrow: Education for Sustainable Development"
- 6-8 December, Queens Park Hotel, Bangkok, Thailand
- **Email:** apeidconf@unescobkk.org
- **Web:** www.unescobkk.org/education/apeid/conference

23

Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Coordinator

Our Commitment for the Future Sustainability

Norihito Tambo

Professor and President
University of the Air, Japan
E-mail: tambo@u-air.ac.jp

Our Commitment for the Future

Sustainability

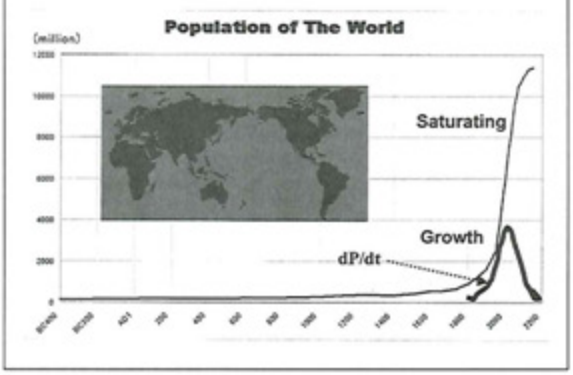
TAMBO, Norihito

President of University of the Air, Japan

August 8, 2006 at Hokkaido University

END OF MODERN SOCIETY

- We are about to be at "the end of modern society"which has continued more than 200 years since 18th century.
- It has been developed and expanded from 15th century local European culture & civilization to today's globalized Anglo-American way of doing.
- Human beings occupy 25% of land animals and their livestock occupy nearly 50%.

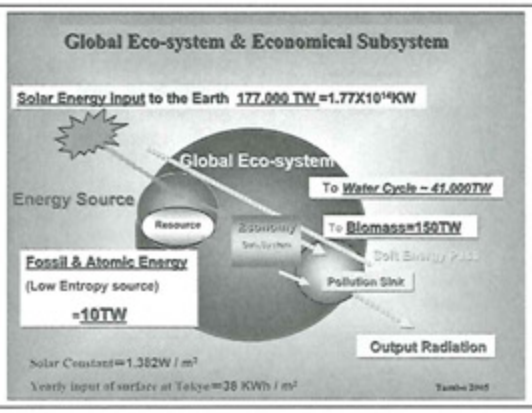


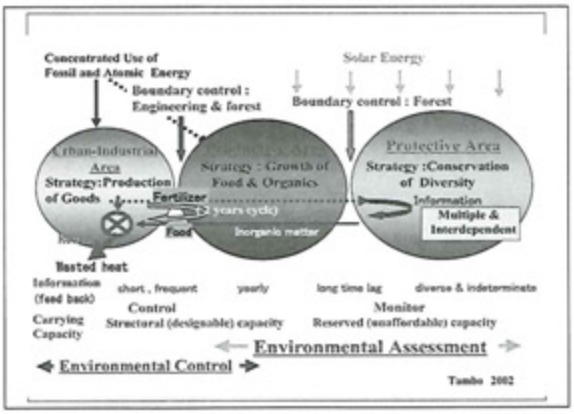
In the last 20th century in 100 years,

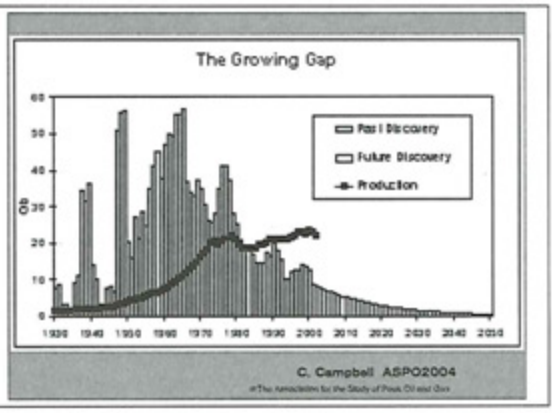
- Population increased: 4 times from 1.5 to 6.0 billion
- Water demand: 10 times
- Energy consumption: 10-11 times
- Economy growth: 17 times
- Per person income increased more than 4 times.
- Efficiency of resources per $ increased 1.7 times.
- Efficiency of resources per person decreased to 0.4

MODERN SOCIETY
Science-based Industrial Society

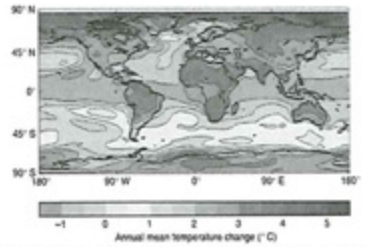
- Modern industry: Simple but large scale industry based on modern science being supported by long distance rapid bulk transportation *with abundant fossil energy & school (departmentalized)education system.*
- Growing society: Growth of individual industry causes increase of total social welfare as the summation of activities.
- Global limit of growth: *Environmental restrictions forced to finish the growth*.







Global Warming for 2050 AD



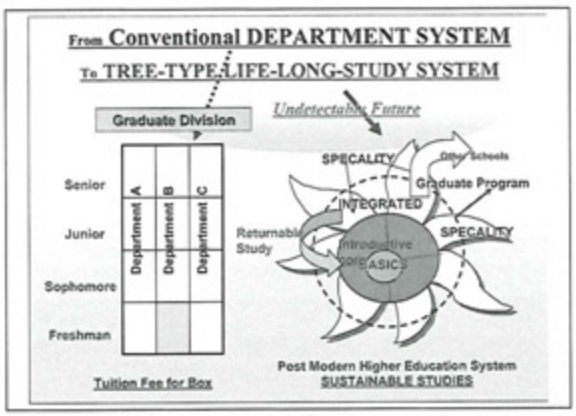
The projected change is compared to the present day with a ~1% increase per year in equivalent CO_2

Source: The Met Office Hadley Centre for Climate Prediction and Research

GLOBAL ENVIRONMENTAL PERIOD

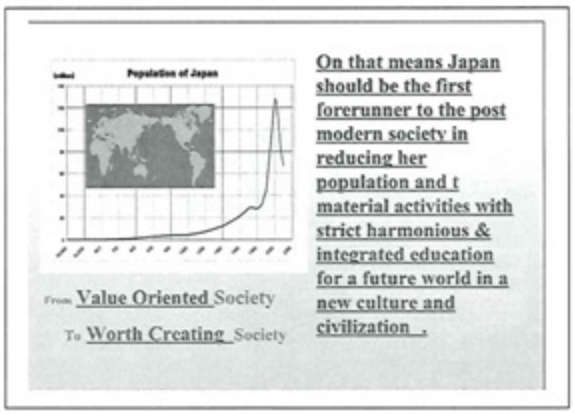
- Difficulty to occupy RESOURCES and SPACE for INDIVIDUAL *(parallel &departmentalized)* ACTIVITIES with/for growth
- NEED for INTEGRATION: in order to *reduce total consumption* of resources, energy and space under the inflating POPULATION PRESSURE and EASY LIFE MODE *to recover SUSTAINABLE SYMBIOSIS on the earth*

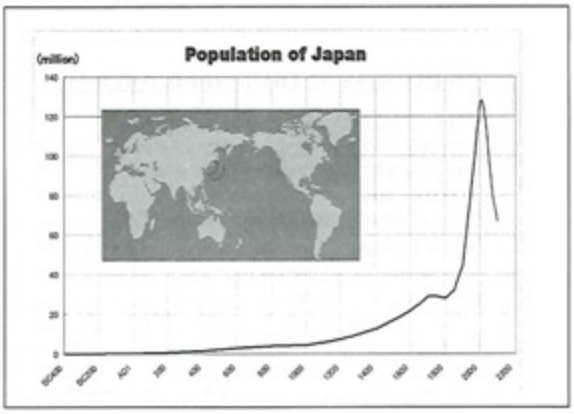
SOUTH TO NORTH PROBLEM IS A KEY ITEM



learn Sustainability of the GLOBE

- ***Development of South Countries to the economic levels of USA, EU and Japan may need 3 or 4 of the EARTH.***
  We have only ONE EARTH unfortunately.
- ***Inevitably it requests to reduce MATRIAL & ENERGY CONSUMING ACTIVITIES of DEVELOPED AREA and total POPULATION with a deep philosophy and clever technology for extended period of time.(education and action)***


Population of Japan
From Value Oriented Society
To Worth Creating Society
On that means Japan should be the first forerunner to the post modern society in reducing her population and t material activities with strict harmonious & integrated education for a future world in a new culture and civilization .

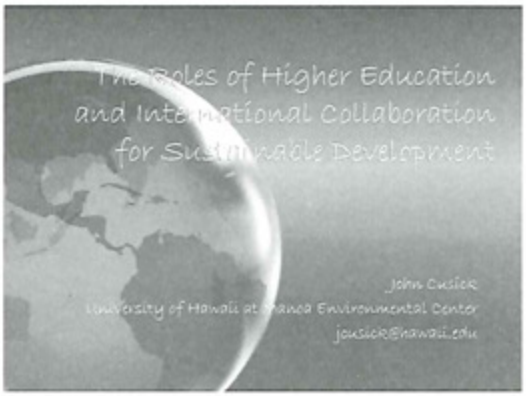

(million)
Population of Japan

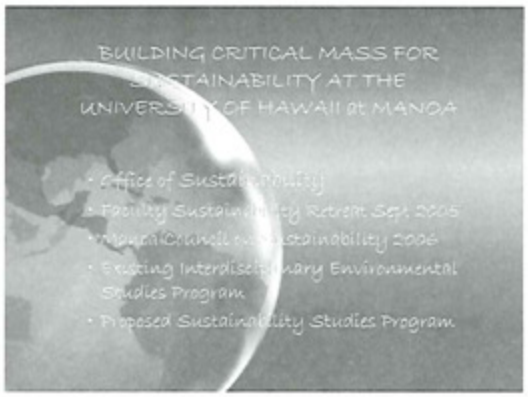
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

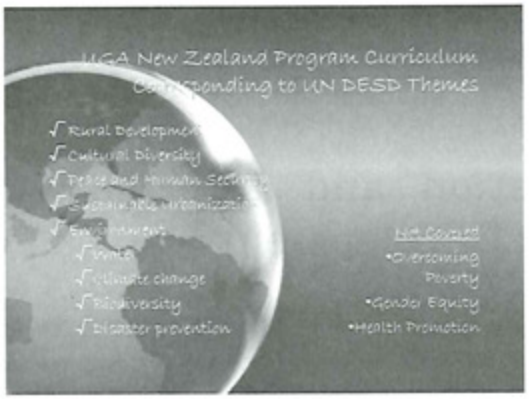
The Roles of Higher Education and International Collaboration for Sustainable Development

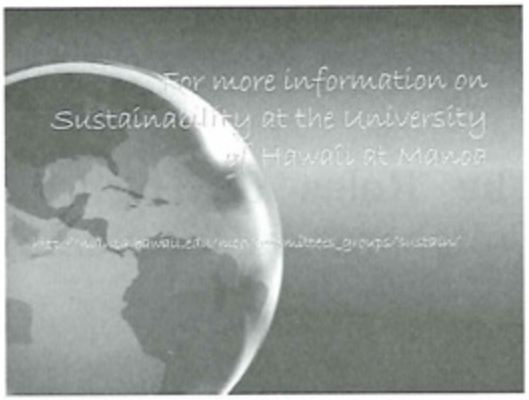
John Cusick

Assistant Specialist
Environmental Center
University of Hawai'i at Manoa, U.S.A.
E-mail: jcusick@hawaii.edu






UGA New Zealand Program Curriculum
Corresponding to UN DESD Themes
√ Rural Development
√ Cultural Diversity
√ Peace and Human Security
√ Sustainable Urbanization
√ Environment
√ Water
√ Climate change
√ Biodiversity
√ Disaster prevention
Not Covered
•Overcoming Poverty
•Gender Equity
•Health Promotion

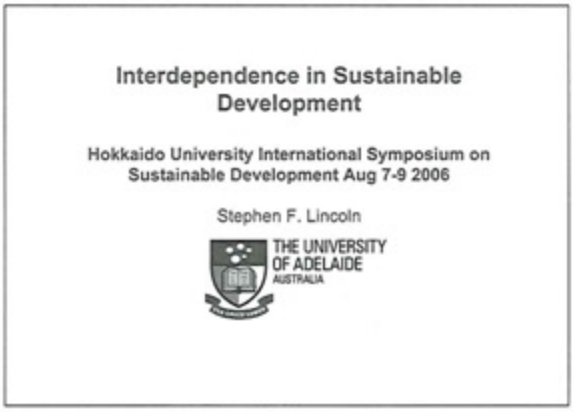

For more information on
Sustainability at the University
of Hawai'i at Manoa

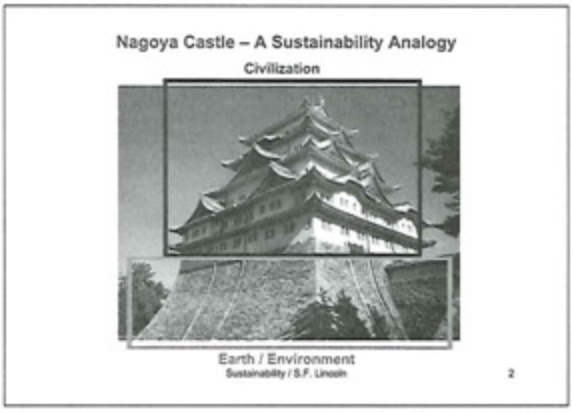
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

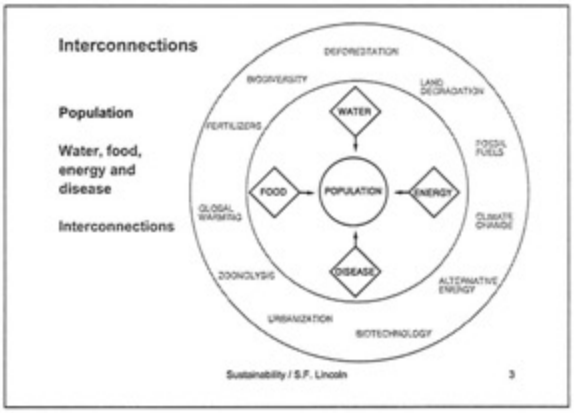
Interdependence in Sustainable Development

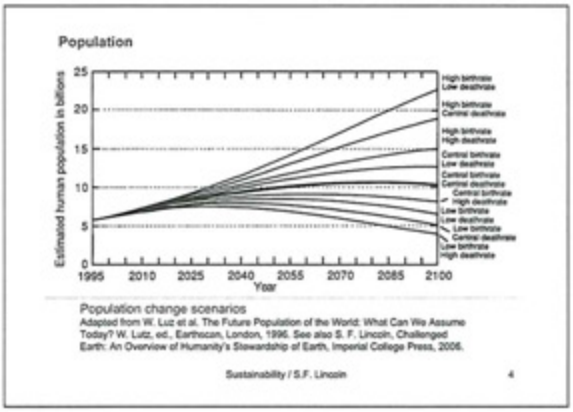
Stephen Lincoln

Professor
Discipline of Chemistry
School of Chemistry and Physics
University of Adelaide, Australia
E-mail: stephen.lincoln@adelaide.edu.au

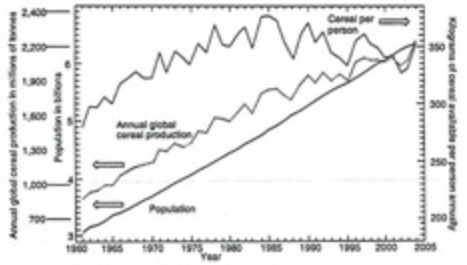








Population and Cereal Supply



Based on FAO Statistical Data Base. http://apps.fao.org

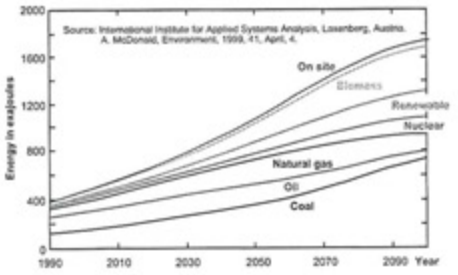
Predicted Food Shortage 2025

Data from the International Water Management Institute

Predicted Water Scarcity 2025

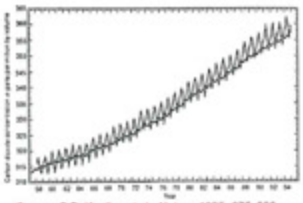
Data from the International Water Management Institute. See also S. F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, 2006

Projected Global Energy Consumption



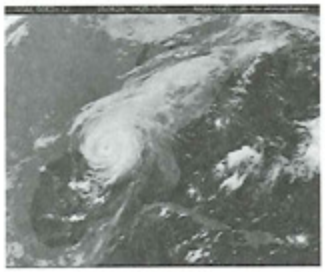
Growth of Tropospheric Carbon Dioxide Levels

- Northern hemisphere levels (Mauna Loa, Hawaii) show large seasonal variation.
- Southern hemisphere levels (South Pole) show small seasonal variations six months out of phase with North.
- Growth of CO_2 levels parallels increase in anthropogenic CO_2 output.



Source: C.D. Keeling et al., *Nature*, 1995, *375*, 666.

Extreme Weather Events

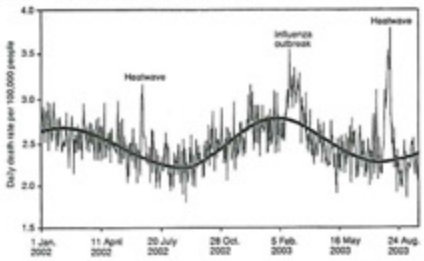


Hurricane Katrina, August 2005

Global warming may be causing climate change and extreme weather events

Image courtesy of NASA

Health – Climate Change and Disease



Daily death rate in Baden-Württemberg.

Adapted from C. Schär, O. Jusktinen, Nature, 2004, 432, 559. See also S. F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, 2006

Research at the University of Adelaide

Climate Change and Sustainability Research Centre:

Integrates:

- Research Cluster in Energy
- Research Cluster for Integrating Sustainability
- Research Cluster for Water

Specific Aspects and People at the University of Adelaide

This list is not exhaustive

Paleoclimate and Biodiversity
Profs. Alan Cooper, Bob Hill, Martin Williams, Steve Donnellan

Ecosystem Restoration and Sustainable Landscapes
Assoc/Prof. David Paton, Dr David Jones

Sustainable Farming
Prof. David Coventry

Urban Habitats
Profs. Chris Daniels, Terry Williamson

Email address: first name.surname@adelaide.edu.au

Specific Aspects and People at the University of Adelaide

Global Change and Coastal Management
Prof. Nicholas Harvey

Population Trends
Prof. Graeme Hugo

Geothermal Energy
Prof. Richard Hillis, Dr Martin Hand

Geosequestralion of CO_2
Prof. John Kaldi

Email address: first name.surname@adelaide.edu.au

Specific Aspects and People at the University of Adelaide

Metal Activated Conversion of CO_2
Dr Mark Buntine, Prof. John Bowie, Prof. Michael Bruce

Nano- and Green Chemistry
Prof. Stephen Lincoln

Alternative Energy and Greenhouse Research
Prof. Keith King, Dr Gus Nathan

Email address: first name.surname@adelaide.edu.au

There is a wide range of undergraduate degrees which contain components teaching aspects of sustainability, climate change and allied areas which feed into research.

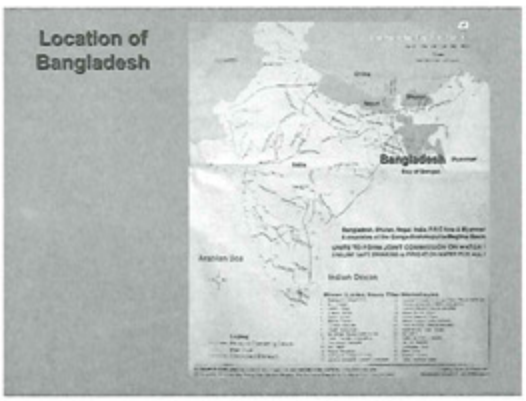
Earth

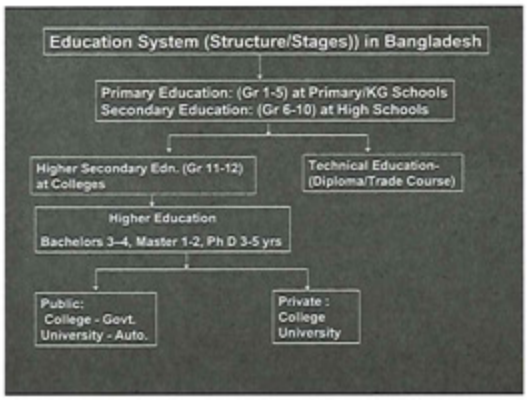
Hokkaido University International Symposium on Sustainable Development
Panel Discussion: Wednesday August 9, 2006 / 9:30am-11:30am
Panelist

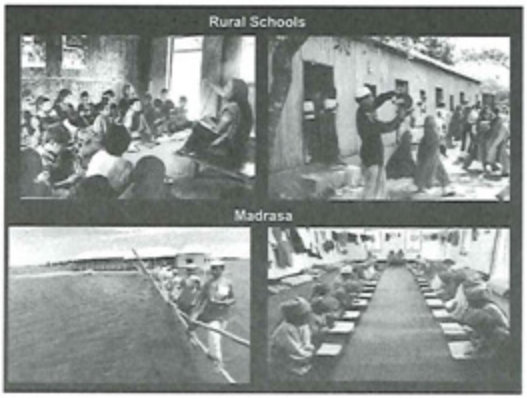
Roles of Higher Education and International Collaboration for Sustainable Development: Bangladesh Experience

M. Harun-ur-Rashid

Director
Training & Communication Wing
Bangladesh Agricultural Research Institute (BARI), Bangladesh
E-mail: dir.tnc@bari.gov.bd







Higher Education: Major Fields

- General (Arts, Commerce, Science, Social Science)
- Engineering
- Agriculture
- Medical
- Religious

Higher Education & Sustainable Development

Components of Ideal Higher Edn.:

- Course work/ Class room Teaching
- Research & Development
- Outreach/Field/Extension Programs
- Exchange program

Features of Sustainable Development:

- Beneficial/Productive
- Accepted by community/stakeholders
- Scientifically/Technologically sound
- Environment friendly
- Replicable

Sustainable Development of Agriculture

- Satisfactory/high agril. production through the application of scientific/technical knowledge
- Low rate of degradation of farm environment
- Conserve natural resources & biodiversity
- Minimal use of external inputs

Higher Education Administration & Sustainable Development

Parameters	General	Engineering	Agriculture	Medical	Religious
Quality of Education	Medium – good	Good	Medium–good	Medium–good	Poor?
Applied Research & Development	Poor–good	Medium	Medium–good	Hospital oriented	Nil
Outreach/Community Linkage Program	Poor	Poor	Medium	Hospital oriented	Nil
Hands- on experience	Poor–medium	Poor – medium	Medium-good	Good (Internship)	Nil
International Collaboration	Poor–good	Poor - good	Poor–good	Poor–medium	Nil
Party Politics	High	Low	High	Medium	V. High

Higher Education Administration & Sustainable Dev. (Contd.)

Parameters	General	Engineering	Agriculture	Medical	Religious
Education cost	G- low P- high	G- low P- high	Low	G-low P-V.high	V. low
Governance	Poor-good	Good	Poor–good	Medium–good	Dict.
Cont. Education	Inadequate	Inadequate	Inadequate	Nil	Nil
Curr/GD	Poor-good	Good	Good	Good	V. poor
Contribution to SD	Low-medium	Medium-high	Medium-high	Medium-high	V. low

Major Problems in Higher Education

1. Lack of good governance and forward looking vision – in many
2. Party politics (both teacher & students) thus biased decisions – in many
3. Lack of coordination among the depts. & the universities
4. Inadequate international collaboration & exchange program
5. Lacks in outreach/community linkage programs

Major Problems in Higher Education (Contd.)

6. Less out door activities- being in the fields allows one to get "hands-on experience" and see the things physically
7. Inadequate resource mobilization in education
8. Lack of facilities for advance Res. and technological development
9. Inadequate continuing education
10. Weak accreditation system

Trends in Government Expenditure on Education (% of GDP)

Fiscal Year	Revenue Expenditure	Development Expenditure	Total Expenditure
1973-1980 av.	0.63	0.27	0.9
1981-1985 av.	0.73	0.23	1.0
1976-1990 av.	1.03	0.30	1.3
1991	1.06	0.16	1.2
1992	1.14	0.21	1.4
1993	1.34	0.47	1.8
1994	1.36	0.66	2.0
1995	1.30	1.06	2.4
1996	1.30	0.83	2.1
1997	1.30	0.90	2.2
1998	1.39	0.77	2.2

Source: BBS and various budget documents quoted in World Bank (1999)

Percentage Distribution of Revenue Expenditure on Education by Sub-Sector

Fiscal Years	Primary	Secondary	Technical	University	NEF	Others	Total
1991/92	48.2	36.8	2.4	8.5	-	4.1	100
1992/93	44.6	40.6	2.3	7.9	-	4.6	100
1993/94	45.4	42.3	2.3	8.2	-	1.8	100
1995/96	43.8	42.6	2.1	8.0	-	3.6	100
1996/97	43.5	42.9	2.1	7.9	-	3.6	100
1997/98	43.0	46.5	1.5	7.4	-	1.6	100
1998/99 (B)	41.6	48.4	1.4	7.1	-	1.5	100

Source: Revised budget estimates as quoted in World Bank (1999)

Percentage Distribution of Development Expenditure on Education by Sub-Sector

Fiscal Years/9	Primary	Secondary	Technical	University	NEF	Others	Total
1991/92	40.1	23.5	7.3	22.3	-	6.8	100
1992/93	66.0	23.5	2.1	7.1	1.2	3.1	100
1993/94	68.2	18.9	1.9	9.3	0.9	0.8	100
1994/95	52.6	41.0	0.4	0.8	2.7	2.5	100
1995/96	45.6	43.6	0.6	3.7	2.9	3.6	100
1996/97	24.2	57.4	1.7	10.9	4.7	1.1	100
1997/98	26.8	45.2	2.2	13.3	9.2	3.3	100
1998/99 (B)	47.3	32.4	3.3	5.3	8.6	3.1	100

Source: Revised budget estimates as quoted in World Bank (1999)

Major Problems in Sustainable Development

1. Political/short term decisions
2. Lack of good governance
3. High unemployment rate
4. Misappropriation of funds
5. Decreased international collaboration
6. Lack of fund

Conclusions

1. Sustainable development and modernization require professionals with broad based education, skills, knowledge and positive attitudes. Education with background of research & development, and outreach programs can help achieve those. International collaboration can help in this regards.
2. To make education more applicable, productive and development more sustainable and global Bangladesh needs more international collaboration.

Conclusions (contd.)

3. With international collaboration, quality & standards of education and research & development are better and capacity building and technology/information generation/exchange etc, become easier and quicker.
4. With international collaboration, agricultural education and research are quite developed/advanced. Though cultivable land in Bangladesh is decreasing by 1% and population increasing by 1.5% (2.5 million people added annually), but food situation is still better now than decades ago. This was possible by the leadership of agricultural graduates with development oriented education. For further progress international collaboration is necessary.

Conclusions (contd.)

5. Madrasa (religious) education is not playing significant role for sustainable development– science, social science and development aspects are almost absent here. International collaboration is more needed in RE to make it scientific and productive.
6. Cooperation and collaboration among academic disciplines, institutes and nations are essential for sustainable development.
7. Bangladesh has huge unemployed graduates with international collaboration they can be utilized in sustainable development.

Conclusions (contd.)

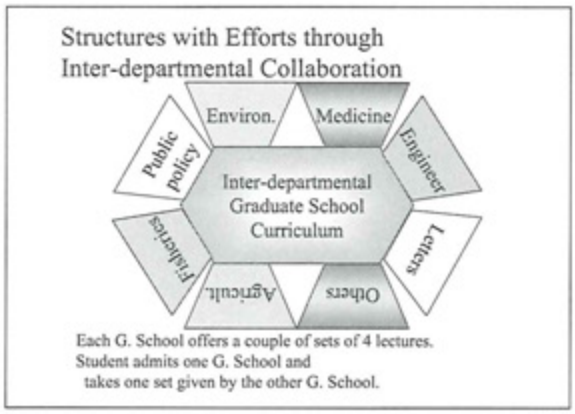
8. Reforms in curricula – focusing on environment, sustainable development, entrepreneurship development, good governance, etc are necessary.
9. To conclude, we can say that, higher education, international collaboration and sustainable development are interwoven in one thread and these three things should be addressed equally and simultaneously.

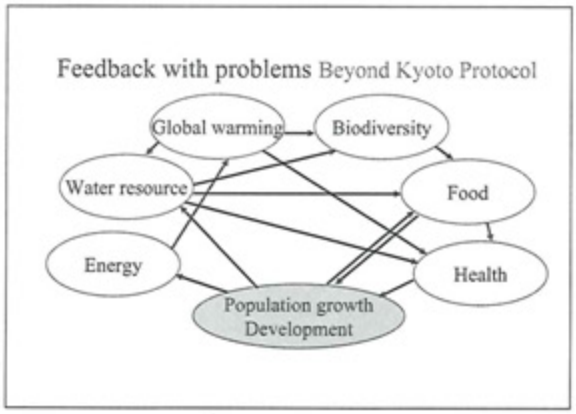
Hokkaido University International Symposium on Sustainable Development
Plenary Session 1: Monday August 7, 2006 / 10:00am-11:50am
Panelist

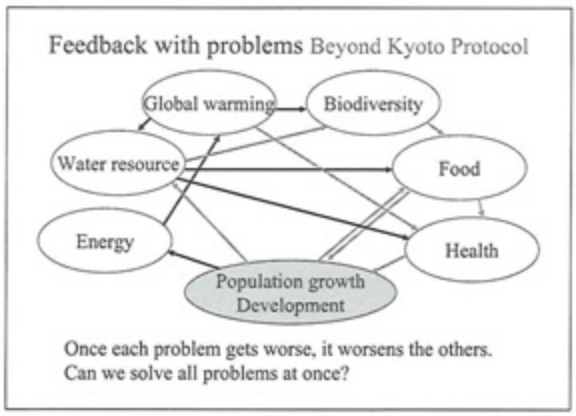
Hokkaido University Inter-departmental Study in Sustainability

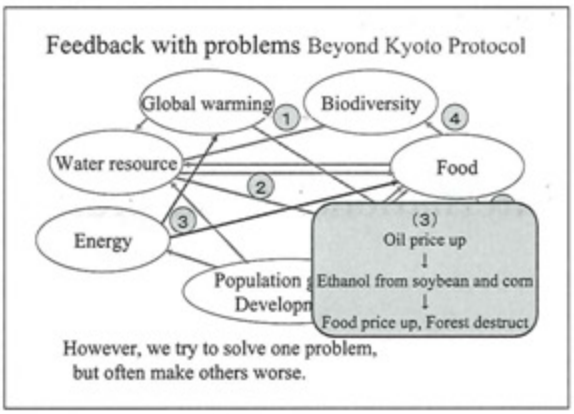
Motoyoshi Ikeda

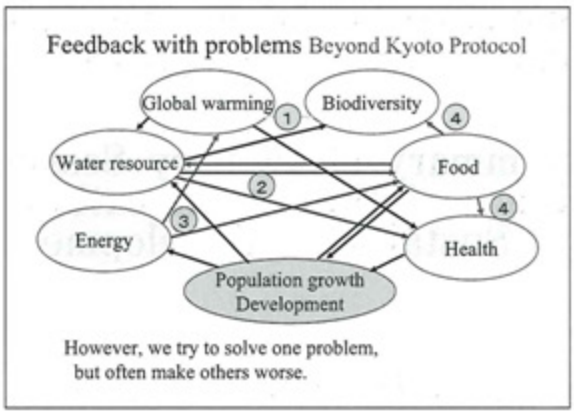
Professor
Division of Environmental Science Development
Faculty of Environmental Earth Science
Hokkaido University
E-mail: mikeda@ees.hokudai.ac.jp

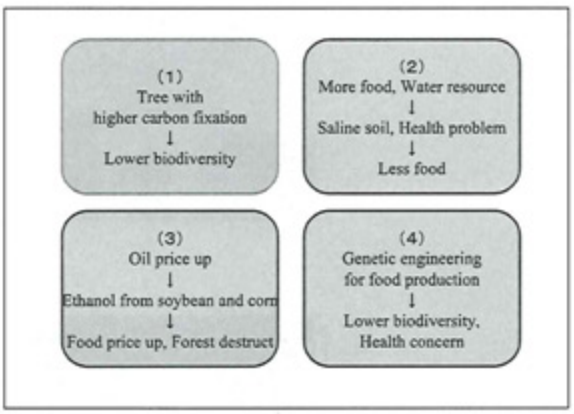


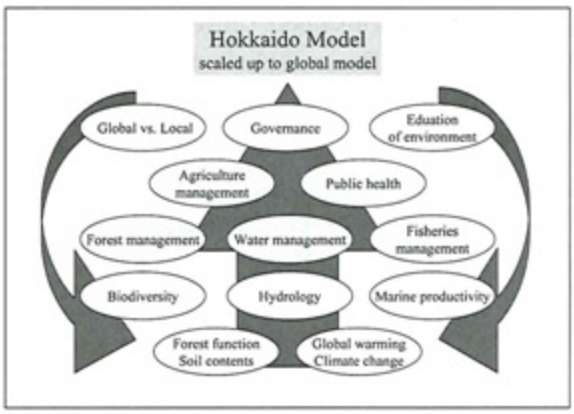





Feedback with problems Beyond Kyoto Protocol
Global warming
Biodiversity
Water resource
Food
Energy
Population
Develop
(3)
Oil price up
Ethanol from soybean and corn
Food price up, Forest destruct
However, we try to solve one problem,
but often make others worse.


Feedback with problems Beyond Kyoto Protocol
Global warming
Biodiversity
Water resource
Food
Energy
Health
Population growth
Development
However, we try to solve one problem,
but often make others worse.


(1)
Tree with
higher carbon fixation
Lower biodiversity
(2)
More food, Water resource
Saline soil, Health problem
Less food
(3)
Oil price up
Ethanol from soybean and corn
Food price up, Forest destruct
(4)
Genetic engineering
for food production
Lower biodiversity,
Health concern


Hokkaido Model
scaled up to global model
Global vs. Local
Governance
Eduation
of environment
Agriculture
management
Public health
Forest management
Water management
Fisheries
management
Biodiversity
Hydrology
Marine productivity
Forest function
Soil contents
Global warming
Climate change

Hokkaido University International Symposium on Sustainable Development
Plenary Session: Wednesday August 9, 2006

Summary of Plenary Session 1: Roles of Higher Education and International Collaboration in Sustainable Development

Chaired by **Takeshi Kishinami**

Vice President, Hokkaido University
E-mail: kisinami@coin.eng.hokudai.ac.jp

Co-chaired by **Midori Yamagishi**

Professor, Center of Research and Development in Higher Education, Hokkaido University
E-mail: midoriy@high.hokudai.ac.jp

Keynote Speaker:
Sheldon Shaeffer, Director, UNESCO Asia and Pacific Regional Bureau for Education, Bangkok
"Education for Sustainable Development: If Not the Solution, At Least a Start"

Panel Discussion: Roles of Higher Education and International Collaboration for Sustainable Development
Coordinator:
Norihito Tambo, President, University of Air, Japan
Panelists:
John Cusick, Assistant Specialist, Environmental Center, University of Hawai'i i at Manoa, U.S.A.
Stephen Lincoln, Professor, School of Chemistry and Physics, University of Adelaide, Australia
M. Harun-ur-Rashid, Director, Training & Communication Wing, Bangladesh Agricultural Research Institute (BARI), Bangladesh
Motoyoshi Ikeda, Professor, Faculty of Environmental Earth Science, Hokkaido University

While the urgency and the need for action on Sustainable Development is well recognized in many countries, there have been a great many of discussions on effective models and strategies for achieving this goal. There is no universal model of education for sustainable development (ESD). This session is designed to focus on the role of higher education in a cross-national context in the implementation of sustainable development.

The session began with a keynote address by Dr. Sheldon Shaeffer, Director of UNESCO Bangkok. Dr. Shaeffer outlined the vision of the UN Decade of ESD which UNESCO is promoting as a leading agency. He emphasized the importance of a partnership approach and the cultural component of sustainable development. A panel discussion presided by Dr. Tambo, the president of the University of Air, followed. Dr. Tambo raised the issue of sustainability and stressed the need of our commitment to the future. Each of the four panelists from higher education representing Australia, Bangladesh, Japan, and the USA, reported the current situation regarding ESD at his institution and the possibilities for future international collaboration on sustainable development (See copies of ppt. files). The issues and concerns related to ESD in undergraduate and graduate programs were discussed jointly with the audience on the floor.

Panelists provided several examples of multidisciplinary activities and innovative curricula involving sustainable development. The awareness of ESD, however, appears to be high among researchers predominantly in science and engineering fields. It was repeatedly brought up by the floor that more needs to be done in terms of connecting other sustainable development-related fields, particularly social sciences and humanities. Such issues as moral, ethical, fairness, social values, and attitudes towards consumption were assured to be included as the vital parts of ESD. In addition, high expectations were shown towards international collaboration. Benefits of various forms of collaboration were discussed; projects and case studies jointly coordinated by developed and developing countries, study-abroad programs, field trips, and eco-tours. An innovating interdisciplinary course on the Mekong Delta, offered in general education at the U. of Maryland, was briefly mentioned by the floor. The two-semester course was designed and taught by a mixed group of faculty members in the natural and social sciences with a focus on sustainability in the Mekong Delta. It provided students with the opportunity for an interdisciplinary examination of the region (history, culture, water and energy needs etc.) and related sustainability issues (a dam-building project, ecological and human threats of dam-building.). Furthermore, a three week study abroad program in China and Vietnam was offered to students so that they might examine what they had learned in the classroom in the actual world.

There was a feeling in this session that the biggest barrier to the promotion of ESD is the discipline-based system in academia. It is often the case among universities that the discipline (i.e. department) is the unit which allocates the resources and incentives. Therefore, multidisciplinary undergraduate programs such as those focusing on sustainable development, which involves the integration of the environment, the economy and society, are at a considerable disadvantage when it comes to getting resources, unless strong leadership exists. Dr. Tambo strongly argued that the departmental system, which dominates in the era of the modern university, needs to be replaced with an alternative system which is capable of solving the problems we face today. As is stated by Dr. Shaeffer in his address, this session concluded that the promotion of ESD requires a fundamental reform in the structure and

nature of education, and that international collaboration among institutions of higher education must facilitate the development of new curricula which will help students to find new solutions to environmental, economic and social problems.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3:Wednesday August 9, 2006 / 1:15pm-1:45pm
Keynote Speaker

Interaction between the Amur River Watershed and the Sea of Okhotsk in the Model of Sustainable Development

Petr Y. Baklanov

Director
Pacific Institute of Geography,
Far Eastern Branch of the Russian Academy of Sciences, Russia
E-mail: pbaklanov@tig.dvo.ru

A sustainable development of a region is its stable development during a long period of time in the economic, social and ecological spheres. This principal thesis is generally accepted in scientific literature. According to it, a region in the model of sustainable development should be considered and embraced as an integral natural and economic system (Fig. 1)

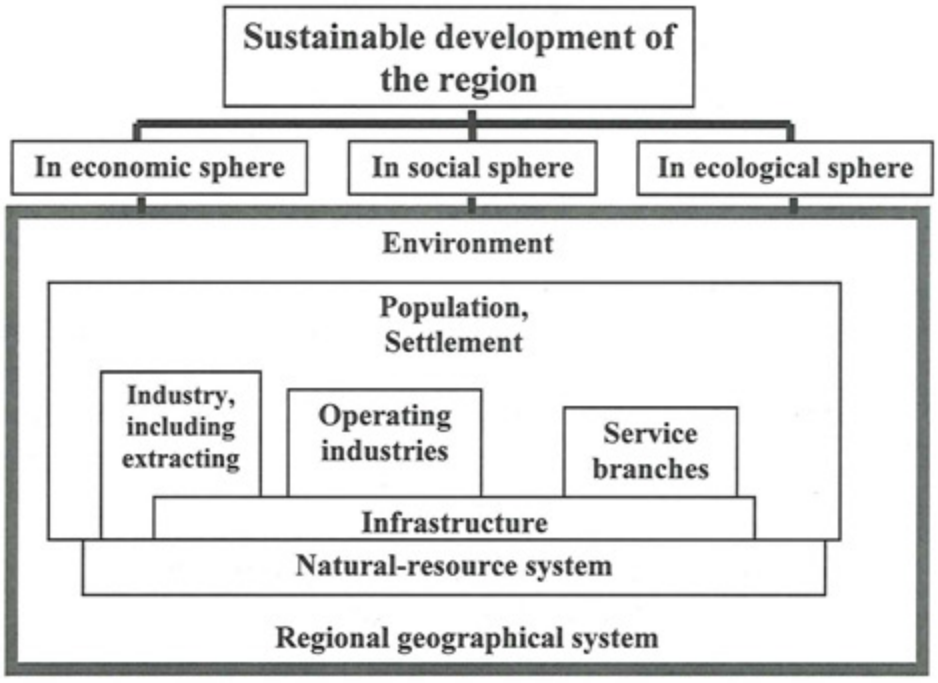


Figure 1. A region in the model of sustainable development

Basic principles of regional analysis in the model of sustainable development are distinguished as follows:

- A region, as an object of sustainable development should be considered as an integral natural and economic system;
- Assessment of dynamics of the region and covering of long periods of time should be taken in;
- Analysis of qualitative characteristics of dynamics, development of the region should be done.

A vision of economic, social and ecological qualities of a regional development has been introduced by the author (Baklanov, 2001).

The economic quality of a regional development is ability of the region due to its own resources to produce such a gross income, which can provide high levels of consumption and accumulation in the region for a long time.

The social quality of a regional development is ability of the region due its own demographic potential and social infrastructure to provide stable population in the region and to maintain high standards of life quality in the region during a long period of time.

The ecological quality of a regional development is ability of the region to maintain its natural-resource potential and high qualities of environment during a long period of time.

A sustainable development of the region is its development with high qualities of a regional development maintained for a long period of time (tens of years). Selection of the main parameters - indices and calculation of criteria and limitations of sustainable development is the major phase in creation of the model of sustainable development of the region (Fig. 2).

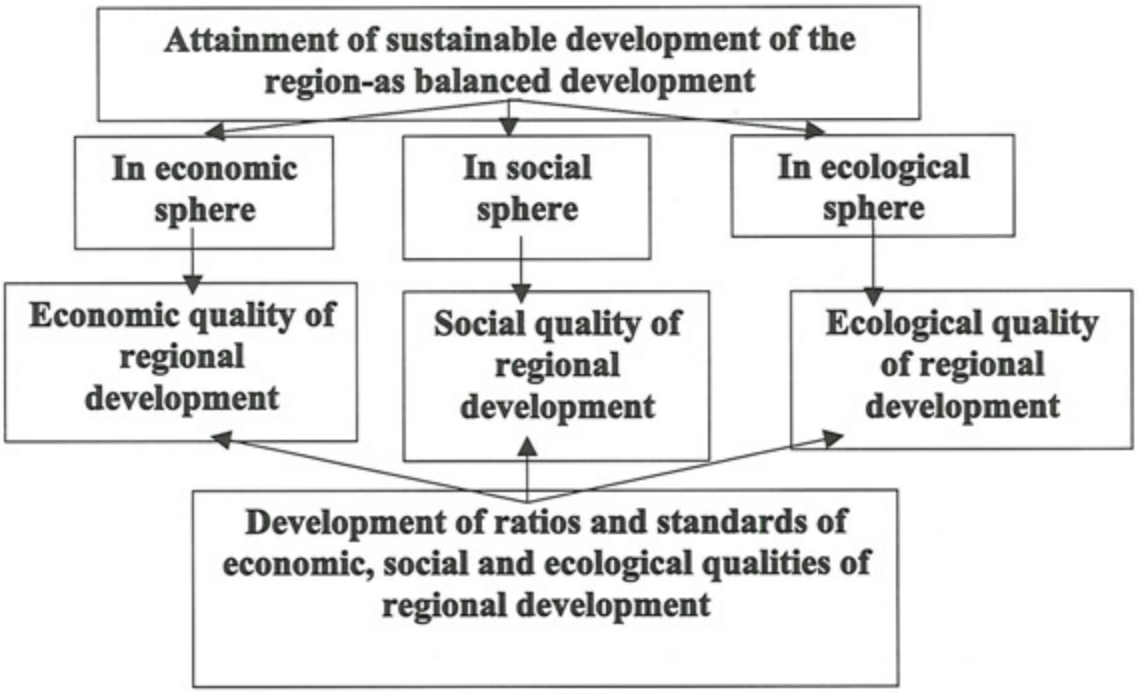


Figure 2. A scheme of sustainable development of the region.

First, the main indices of the region development in economic, social and environmental spheres are selected as indicators I_1, I_2 and so on. Then, the optimum values of these indicators as standards S_1, S_2 and so on are calculated.

- Setting standards - optimum values of the indicators

  S_1, S_2, S_3.....S_n

- Then, assessment of deviation of the actual indicators from the standards:

  $S_1 - I_1 = K_1$

  $S_2 - I_2 = K_2$

  K_1, K_2 etc. are criterions of sustainable development.

The assessment of various characteristics, indicators of actual state of the Amur-Okhotsk region has been done. The regions of Amur River and the Sea of Okhotsk are considered here as a model of a sustainable development (Fig. 3).

Figure 3. The Sea Of Okhotsk watershed including Amur River basin.

As a whole, the basin of the Sea of Okhotsk includes the basin of Amur River. Taking into account the large size of the Amur River basin and its considerable influence on the resource and environmental state of the Sea of Okhotsk, this geosystem can be considered as composed from two interacting tiers (Fig. 4).

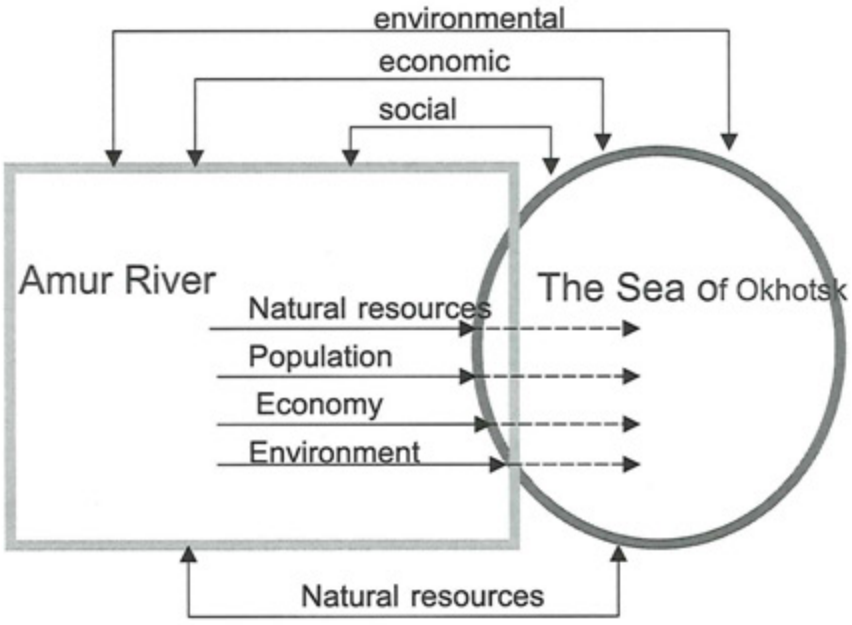


Figure 4. the Amur-Okhotsk two-tier geosystem.

The Amur River basin (the first tier) is an integrated geosystem (ecosystem). Different parts of the basin territory are related each other with natural processes, namely: surface water drainage, geochemical and ecological ones. Technogenic contaminations of some areas transfer to other areas through the Amur River tributaries. For instance, an emergency dumping of considerable volume of nitrobenzene to Sungari River in the People's republic of China in the end of the 2005 year entailed a contamination of waters and sediments of Amur River and its banks. By this reason, the basin geosystem should be studied and assessed as entire and integrated ones. If they are crossed by the state boundary, they become trans-boundary territories. The geosystems of Amur River and the Sea of Okhotsk are such geosystems namely. Nevertheless, it is expedient to carry out their survey, assessment and general organization of nature management within them according to the agreed international programmes (Baklanov, Ganzey, Kachur, 2005). Under relative independence of the Amur River and the Sea of Okhotsk basins, they are interacting between each other, first of all by means of fluid and solid river flow, atmosphere transfer, and other processes and links. The Japanese-Russian Amur-Okhotsk Project is devoted to the assessment of some of these relations (Fig. 4).

Below is the main characteristic - indicators of the Sea of Okhotsk basin (Fig. 5)

Figure 5. The Sea of Okhotsk basin
Blue line- borders of the Sea of Okhotsk Basin without Amur River Basin.
(from The Atlas Of Commercial Invertebrates And Algae Of The Russian Far East Seas. I. Arsamastsev ed., 2001)

We assessed an availability and combination of natural resources in separated districts of the Sea of Okhotsk. The following map was compiled in result of it (Fig. 6).

Figure 6a. Biological resources zoning (from Nature management in the coastal zone. Vladivostok. 2003)

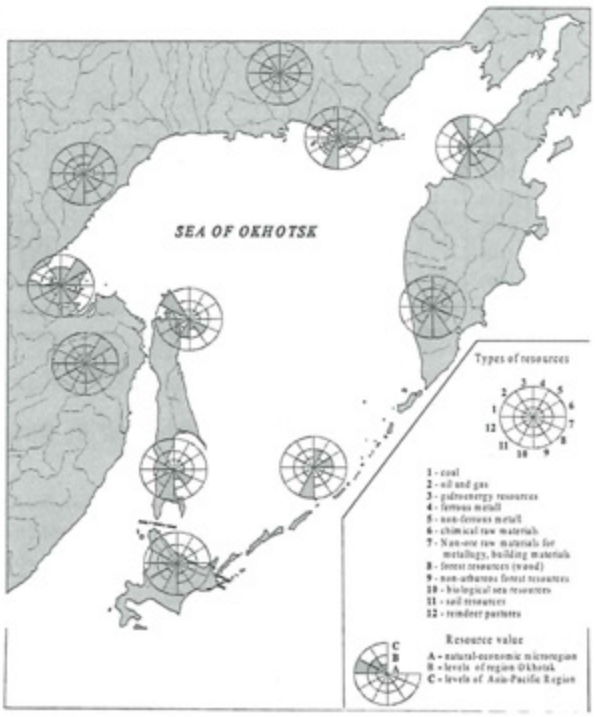


Figure 6. Territorial combination of the natura resources

The vast perspectives of this region are associated with availability of significant deposits of oil and gas resources on the shelf (Fig. 7).

Figure 7. Areas of perspective development of the oil and gas fields in the Sea Of Okhotsk Basin (1 - perspective fields of the gas and oil (from Alekseev A.V., Baklanov P.Ya., et al. Development strategy of fuel and energy resources for the Far East Economic Region up to 2020. DalNnauka Publishing House, Vladivostok, 2001).

At present, oil and gas are extracted in Yakutia and on SakhalinIsland, mainly on the north-eastern shelf (Fig. 8,9).

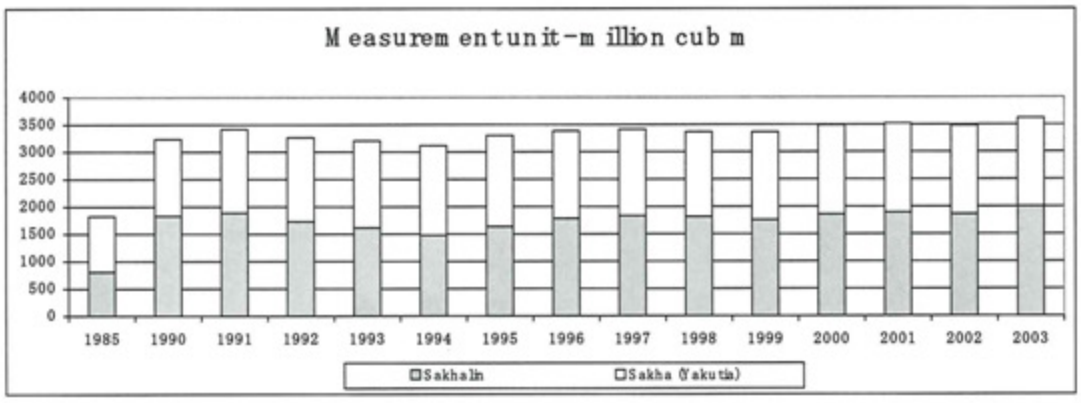


Figure 8. Gas Production Dynamics in the Russian Far East (from The Regions of Russia. Moscow, 2005).

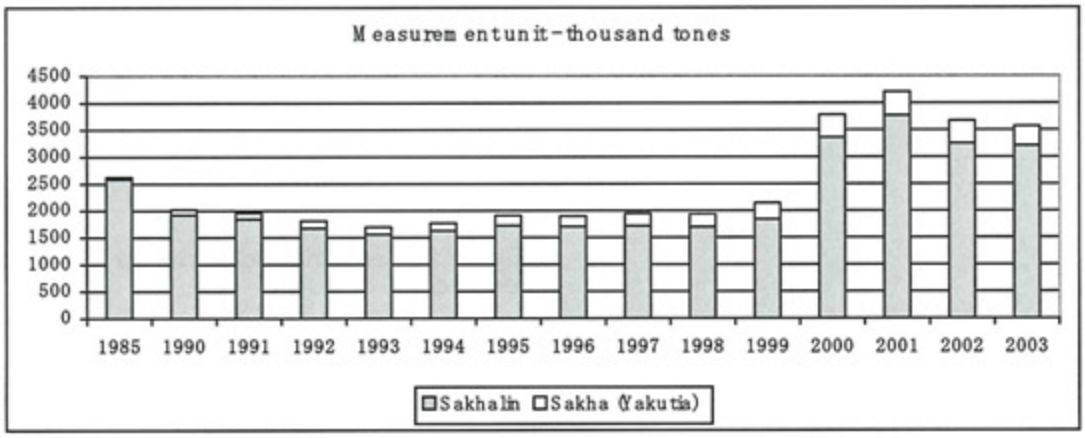


Figure 9. Oil Production Dynamics in the Russian Far East (from The Regions of Russia. Moscow, 2005).

Extraction of oil and gas resources will grow in future (Fig. 10). Construction of oil and gas processing factories, wide development of oil and gas pipelines network are also possible there. At the same time, it means an increasing of possible technogenic impacts on ecosystems of Amur River and the Sea of Okhotsk.

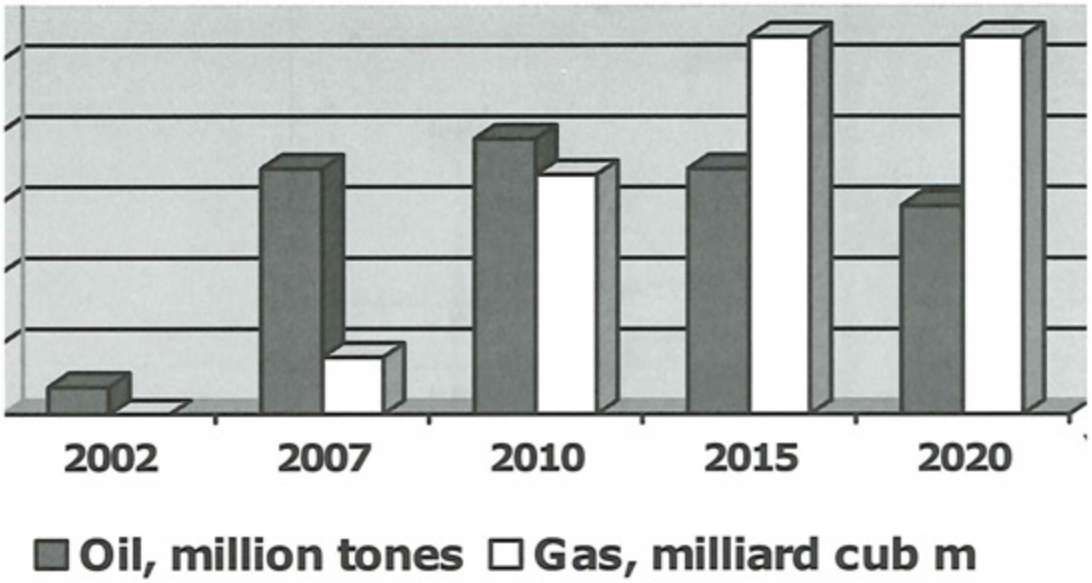


Figure 10. Predicted volumes of oil and gas production by Sakhalin-1 and Sakhalin-2 Projects (from The development strategy 2001)

Rather small population, over 1 million people live in the basin of the Sea of Okhotsk (Table 1).

Table 1. Population In Sectors Of The Sea Of Okhotsk Basin (thousands of people, 2000)

Sectors of the Sea of Okhotsk basin	Population in sector, people
Sakhalin +Kurils	335.000
Magadanskii	125.000
Khabarovskii	407.000
Kamchatkii	24.000
Japanese (Hokkaido Island)	310,000

(source – author's calculations)

Correspondingly, there is small density of population (Fig. 11). It stipulates moderate anthropogeneous contamination of the Sea of Okhotsk with communal discharge and waste.

Figure 11. Density of population:
1 - Territories without permanent population;
2 - population density lesser than 5 people/km2;
3 - population density - 5-25 people/km2.
4 - urban population, 100-1000 thousand people;
5 - less than 100 thousand people
(Ecological atlas of Russia, 2002).

The general indicators of economic development in the Sea of Okhotsk region are given in Table 2.

Table 2. Basic Economic Characteristics Of Sectors of the Sea of Okhotsk Basin in 2000 (source - the author's calculations according to The Regions of Russia. Moscow, 2005).

Sectors of the Sea of Okhotsk basin	Population in sector, people	Share of total population of administrative territory, %	Gross regional product, millions of US $	Industrial output, millions of US $	Volume of agricultural production, millions of US $	Cost of basic assets of economics branches, millions of US $
Sakhalin +Kuril	335,000	61,24	722.9	615.8	38.1	2169.4
Magadanskii	125,000	68,41	286.6	244.6	8.5	1110.1
Khabarovskii	407,000	28,4	642.2	557.6	36.4	2931.5
Kamchatkii	24,000	6,3	37.2	32.7	3.5	134.3
Japanese (Hokkaido Island)	310,000	6,1	1200254 mln. yens.			

Industries are mainly situated in the Sakhalin sector of the Sea of Okhotsk basin and in lower reaches of Amur River, Khabarovskii Krai (Fig. 12). Correspondingly, there are concentrated the major technogenous impacts.

Figure 12 Industrial nodes of the Okhotsk region
(source - the author's calculations according to The Regions of Russia. Moscow, 2002).

In recent years a growth of industrial manufacturing is observed there, but the growth is not steady (Table 3).

Table 3. Growth rates of industrial production (as percentage of preceding year).

	1995	1998	2000	2001	2002
Khabarovskii Krai	81	104	125	112	105
Kamchatkaya Oblast	108	95	107	101	93
Magadanskaya Oblast	86	96	101	108	106
Sakhalinskaya Oblast	109	104	113	110	87

Local agriculture is weakly developed there (Table 3).

Table 4. Production of agriculture by farms of all categories (in actual prices, millions rubles / millions US$)

Region	2000	2001	2002
Khabarovsk Krai	3841 128	5167 172	5930 198
Kamchatka Oblast	1649 55	1724 57	2114 70
Magadan Oblast	374 12	419 14	618 21
Sakhalin Oblast	1865 62	2890 96	2628 88

(source - the author's calculations according to The Regions of Russia. Moscow, 2003).

Small agricultural areas are situated in Sakhalin sector and in Khabarovskii Krai. Focal allocation of agriculture is in Magadanskaya and Kamchatskaya oblasts (Fig. 13).

Figure 13. Agricultural Landscapes Development
1- weak level of development with a share of agricultural lands of 1-5% of total area of a landscape and area of arable lands of less than 1-5 %;
2- weak level of development with a share of agricultural lands of 1-10% of total area of a landscape and area of arable lands of less than 1 %;
3- very weak level of development with a share of agricultural lands of 1 % of total area of a landscape and area of arable lands of less than 0.1 %;
4- landscapes used as hunting and agricultural lands;
5- tundra and tundra-forest landscapes, used partially as the deer pastures;
6- Taiga landscapes.
(Source - Ecological Atlas of Russia, 2002)

The Sea of Okhotsk is an important region for the Russian fishery in the Far East (Table 5).

Table 5. Catches of commercial fishes in different years (thousands tones).

	1992	1994	1996	1998	1999	2000	2001	2002	2003
By Russia's fleet in the Far Eastern basin (according to DalRyba data)	3,159.4	2,317.9	2,982.9	2,959.6	2,642.7	2,284.3	2,145.0	1,751.0	2,005.6
By Russia's fleet in the Sea of Okhotsk (according to DalRyba data)	1,510.8	1,495.9	2,132.6	1,878.4	1,454.1	1,418.5	1,257.8	865.3	1,060.0
By Russia's and foreign fleets in the Sea of Okhotsk (according to Radchenko)	2,353.2	1,775.2	2,417.6	2,030.0	1,584.2	1,509.1	1,308.7	–	

(source - The Sea of Okhotsk Project, GIWA)

The sea transportation and port development have an omportantn economic meaning for this region (Table 6).

Table 6. Consignments by sea transport from commercial ports (millions tones)

Ports of regions	1970	1980	1990	1997
Primorskii Krai	14,7	17,4	27,9	10,0
Khabarovskii Krai	4.3	6.6	7.7	1.9
Kamchatskaya Oblast	1,2	0,9	0,8	0,6
Magadanskaya Oblast	0,7	1,0	1,4	0,5
Sakhalinskaya Oblast	4,0	5,5	5,2	2,7
TOTAL	24,9	31,4	43	15,7

(Source: Transport and Communication of Russia. Moscow, 1997)

Some characteristics showing the environmental state of the Sea of Okhotsk areas, i.e. environmental indicators are given below (Tables 7, 8, 9).

Table 7. Fresh Water Consumption (millions cubic meters)

Region	1991	1995	2000	2001
Khabarovskii Krai	714	558	465	467
Kamchatskaya	309	276	261	252
Magadanskaya	144	137	90	96
Sakhalinskaya	455	376	275	273

(Source - The Russian Regions. Moscow, 2002.)

Table 8. Basic hydrological characteristics of Amur River and river run-off to the Sea of Okhotsk

Characteristics	Value
Water run-off, average, long-term, km^3	369.1
Run-off maximum, annual, km^3	459.2
Run-off minimum, annual, km^3	135.0
Maximum water discharge, m^3/s	40 000
Minimum water discharge, m^3/s	153
Average annual flow of detritus, millions of tons	24.0
Average annual water turbidity, mg/dm^3	90.0
Maximum water turbidity, mg/dm^3	517.0
Average annual flow of dissolved matter, millions of tons	20.23
including Ca^{2+}	2.34
Mg^{2+}	0.74
$Na^+ + K^+$	1.60
HCO_3^-	10.40
SO_4^{2-}	2.10
Cl^-	1.10
Average annual flow of organic matter, millions of tons	5.3

According to assessments of Institute of Water and Ecological Problems, FEB RAS (2004)

Table 9. Production of toxic waste of production and consumption (thousands of tons)

Region	2000	2001
Khabarovskii Krai	412	305
Kamchatskava	145	107
Magadanskava	857	940
Sakhalinskava	227	213

(*Source*: Russian Regions. 2002. Moscow, 2002.)

One can come to a general conclusion that by now the aggregated anthropogeneous impacts in the Sea of Okhotsk basin is not large (Fig. 14).

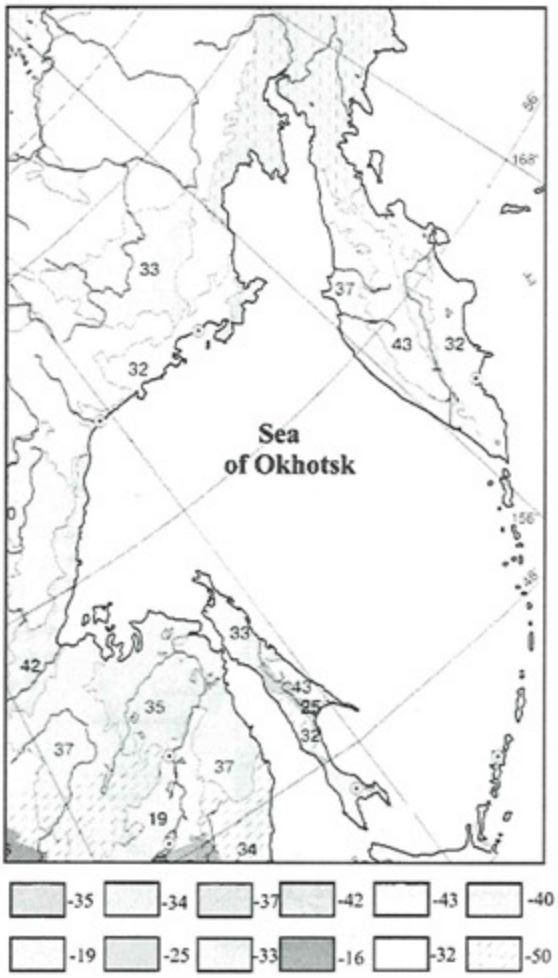


Figure 14. Anthropogenic loads on landscapes:
35- very low urbanization, population density, share of ploughed-up territory, technogenic contaminations;
34- low urbanization, population density, share of ploughed-up territory and practical absence of technogenic contaminations;
37- very low urbanization, population density, share of ploughed-up territory and practical absence of technogenic contaminations;
42- low population density, share of ploughed-up territory and practical absence of technogenic contaminations;
43- insignificant population density and practical absence of ploughed-up territory and technogenic contaminations;
40- insignificant urbanization, population density and practical absence of ploughed-up territory and technogenic contaminations;
19- medium urbanization, population density, low share of ploughed-up territory and sufficient technogenic contamination;
25- not high urbanization, population density, low share of ploughed-up territory and moderate technogenic contamination;
16- medium urbanization, population density, share of ploughed-up and moderate technogenic contamination;
32- low urbanization, population density, share of ploughed-up and moderate technogenic contamination;
50- intense exploitation of forests
(from The Ecological Atlas of Russia, 2002)

The authors (Baklanov, Ganzey, Ermoshin, 2005) assessed an availability and distribution of natural resources in various Russian-Chinese sectors of the Amur River basin (Fig. 15). There is a concentrated natural resources potential, and differentiated structures of nature management are developing

Fig. . The Basin of the Amur River.

Figure 15. Types of natural resources in the basin of Amur River

The Russian part of the Amur River basin is the most developed region of the Far East. The varied industries are located there. One can judge about their structure according to the Tables 10 and 11.

Table 10. Sectoral structure of industrial output in the Russian Far East in 2000, % of regional GDP.

Region	Electric power industry	Fuel industry	Nonferrous metallurgy	Chemical and petro-chemical industry	Mechanical engineering including shipbuilding and ship repair	Wood, woodworking and pulp and paper industry	Food-processing industry including fish complex	Other
Primorsky Krai	16.4	2.1	3.7	1.0	16.3	6.8	46.7	7.0
Khabarovskii Krai	8.5	7.9	8.4	1.6	50.4	8.0	8.5	6.7
Amurskaya Oblast	34.4	4.7	29.6	0.1	6.3	5.7	10.2	9.1
Kamchatskaya Oblast	20.1	0.3	8.3	0.1	4.0	0.6	63.3	3.3
Magadanskaya Oblast	15.3	1.1	66.4	0.0	1.5	0.3	14.0	1.4
Sakhalinskaya Oblast	6.0	60.6	0.2	0.1	1.2	3.2	27.4	1.3
Edreiskaya Autonomous Oblast	13.5	0.2	4.7	0.5	25.4	5.5	13.3	36.9
The Far East as a whole	11.4	13.2	29.8	0.6	16.7	4.1	19.8	4.4

(Source - The Russian Regions. Moscow,2002)

Table 11. Production of the main kinds of an industrial output in the Far East Region of Russia.

A kind of production	1985	1990	1995	1996	1998	2000	2000 to 1990 year
Power generation, million kw-h	38.1	47.5	38.5	37/4	35.0	38.8	0.8
Coal mining, million tons	51.6	49.8	33.8	32.4	27.8	28.3	0.6
Oil production, million tons	2.6	2.0	1.9	1.8	1.9	3.7	1.8
Oil refining, million tons	9.4	9.9	3.5	3.5	3.7	6.3	0.6
Gas production, billion cubic metre	1.8	3.2	3.3	3.4	3.4	3.5	1.1
Timber production, million cubic metre	26.1	23.5	7.4	6.5	4.9	8.4	0.4
Saw-timber production, million cubic metre	6.2	5.4	1.0	0.7	0.5	0.7	0.1
Catch of fish and sea products, million tons	4.2	4.6	2.8	3.0	3.0	2.3	0.5

(Source - Russian Regions. Moscow,2002)

According to Table 11, the main industries in the Amur River region are electric energy production, mining of coal and nonferrous metals, timber production and its partial processing, food industry.

Various kinds of transportation are also developed in the south of the Russian Far East, mainly in the Amur River basin (Table 12). All these kinds of transportation play a great role both in economic and social development of these regions.

Table 12. Transport accessibility of the Far East territory and its serviceability.

Basic indices	Primorsky Krai	Khabarovskii Kraiii	Amurskaya Oblast	Sakhalinskaya Oblast	Kamchatskaya Oblast	Magadanskaya Oblast
Distance from Moscow to the Oblast's centre, km	9302	8533	7985	10417	11 876	10511
Average distance between the urban settlements, km	54	129	95	40	172	146
Extension of navigable river sections, km	222	2999	1963	-	-	990
Number of marine coastal points(do you mean ports?)	34	38	-	74	34	50
Operational length of railways, km (1998) Density of railways per 10 000 km^2	1566 94	2307 29	2982 82	957 110	- -	- -
Length of motor roads (including departmental ones) (1998) (km) Density of motor roads for general use with hard surface, km per 1000 km^2	9647 43	8569 5,7	1156519	2655 21	1520 2,:8	3030 5,8
Provision of population with buses for general use, pieces per 100 000 people, 1999	57	67	54	76	76	103

(Source - Transport and Communication of Russia. 1999. Moscow)

The Amur River basin as a whole is relatively populated, over 85 million people live there, including about 5 million in the Russian part, over 80 million in the Chinese one, and about 50 thousand in the Mongolian part. Large differences in the numbers of population are reflected also in population density. Large contrasts in population density in the Russian and Chinese parts of the Amur River basin can be seen from Figure 16.

Figure 16. Population density along the Russian-Chinese border. (from Ganzey, 2005)

Industries in the Chinese part of the Amur River basin are much more developed like extraction and processing of oil, coal mining, production of construction materials, wood processing, food industry and others. They all lead to far above technogeneous contamination of natural systems and river waters (Fig. 17, 18).

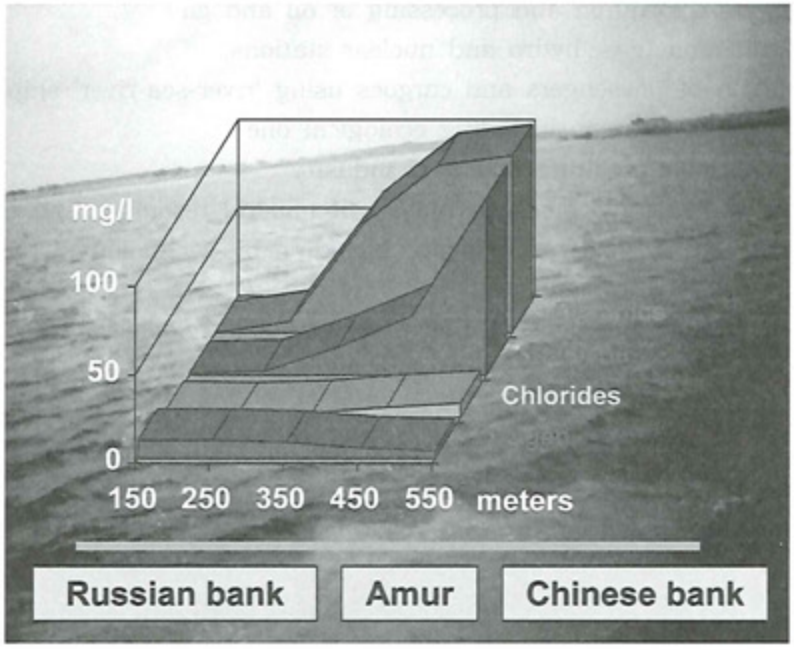


Figure 17. Concentration of pollutants in Amur River waters lower Sungari River mouth. (source - data of the Institute of water and ecological problems, Far East Branch of the Russian Academy of Sciences)

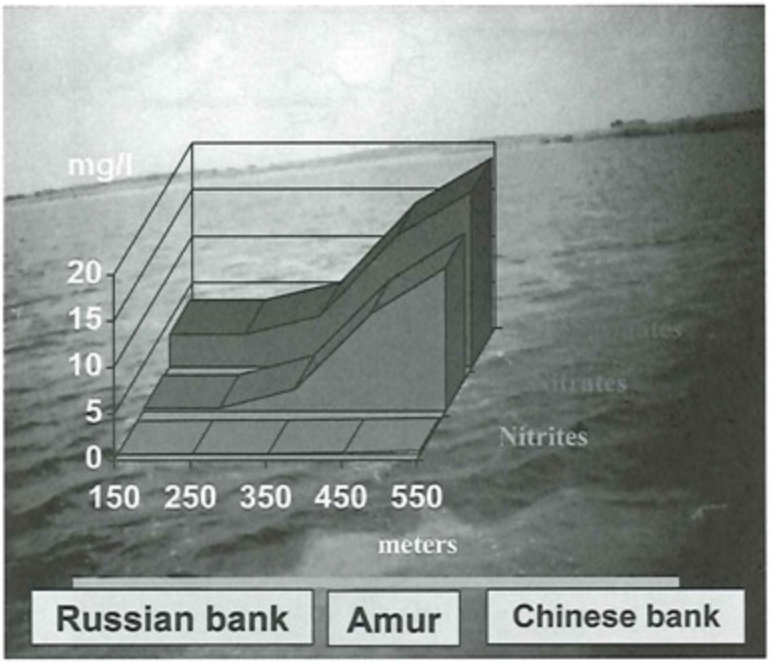


Figure 18. Concentration of pollutants in Amur River waters lower Sungari River mouth (source - data of the Institute of water and ecological problems, Far East Branch of the Russian Academy of Sciences)

On the basis of the analysis of natural and resources factors, and modern social and economic development, we estimate the following perspectives and priorities in the development of the Amur-Okhotsk region namely:

1. Fishery and sea-products processing
2. Extraction, transportation and processing of oil and gas
3. Energy production (gas, hydro and nuclear stations)
4. Transportation of passengers and cargoes using 'river-sea-river' ships
5. Various kinds of tourism, including ecological one
6. Various kinds of agriculture and food industry
7. Harvesting of forest resources, extraction of mineral resources and their processing
8. Development of high-end technologies, including bio-technology

Thus, the sustainable development of the Amur-Okhotsk region in present and in future should be based on rational sustainable nature management.

As a whole, regional nature management is a complicate multi-dimensional process. It can be represented as an interaction of three blocks like population and its activities, combination of natural resources and environment (Fig. 19).

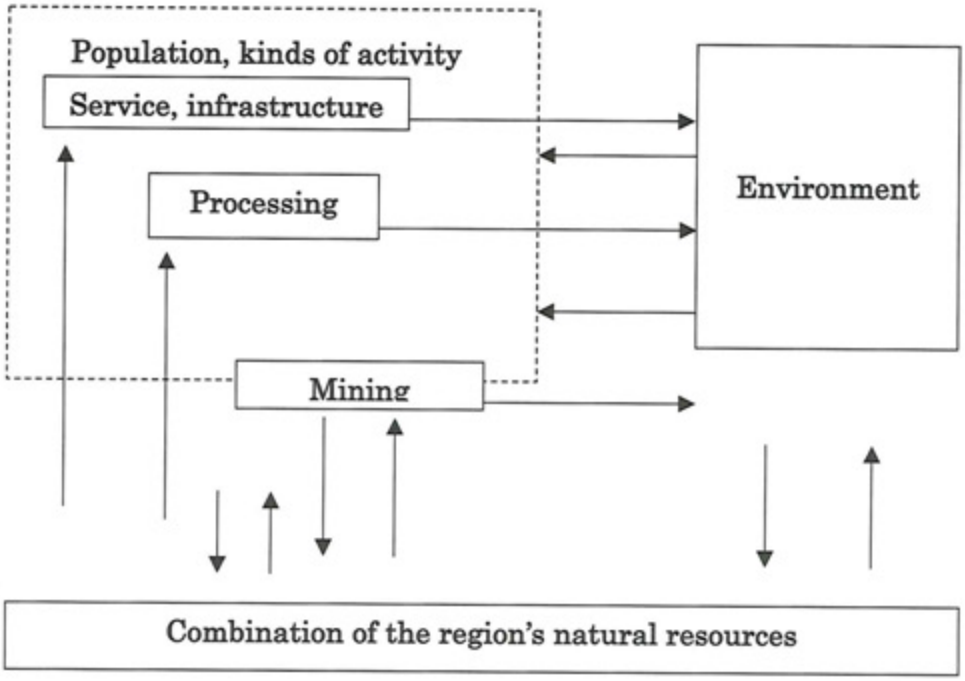


Figure 19. Basic links of the regional nature management

Generalization of the experience of regional nature management and own studies allowed us to formulate the following fundamental thesis as geographical axioms of the regional nature management

- In any kind of the economic activity, a combination of natural resources (land, aquatic, atmospheric etc.) is always used.
- Any kind of the economic activity realizes always a direct and reverse resources consumption. A reverse resources consumption means a reduction of the natural resources potential at the account of technogeneous impacts on natural resources.
- Different links of nature management are members of all components of the regional development.
- The particular links of the regional nature management are always realized and exist in the geographical form, i.e. have a strict territorial expression.
- There are a certain mutual complementarity and spatial-temporal symmetry of social-economic and natural-resource links in the regional development.
- The territorial natural-resource systems are the most complete object of the region's natural-resource potential estimation.

These axioms are important for full coverage and reflection of the regional nature management. The matrix models of nature management in the region have been developed on the basis of these axioms. A scheme of the complete model is shown on Figure 20.

	Activity kinds (enterprises, companies) E_1 E_2 E_3.....$E_к$	**Combinations of natural resources** R_1 R_2 R_3.....R_m	**Environmental components** K_1 K_2 K_3.....K_n	**Total estimations**
Kinds of activity (enterprises, companies)	Economic relations of enterprises, companies	Reverse resources consumption (change in natural resources by the waste of activity kinds)	Technogenic changes of environmental components	
Combinations of natural resources	Direct resources consumption	Inter-resource relations	Effect of extraction of natural resources on the environmental components	
Environmental components	Use of environmental characteristics in the separate kinds of activity	Effect of environmental variations on natural resources	Inter-component relations in the environment	
Total estimations				

Figure 20. The complete matrix model of the regional nature management

To develop the programs of sustainable development of the region, the assessments of dynamics of the regional natural resources potential are very important. For this purpose, the balance model of the regional natural resources potential dynamics has been developed (Baklanov, 2001) (Fig. 21).

Natural resources	R_1	R_2	R_3	R_4	R_5	**Stock (estimates) for t_0**	**Estimates of natural resources dynamics**						**Stock (estimates) for t_1**
							D_1	D_2	D_3	D_4	D_5	$\sum(D)$	
R_1		K											
R_2			K_2										
R_3				K_3									
R_4					K								
R_5	K_5												
Some generalized (summary) characteristi													

Figure 21. A schematic diagram of the dynamic natural-resources balance of the territorial natural-resources system.

Basic parameters of balance:

R_1, R_2, R_3, R_4, R_5 are individual natural resources of the system, for example, land, water, forest, coal, metallic ores etc.

K_{12}, K_{23}, K_{34}, K_{45}, K_{51} are coefficients of inter-resource connections reflecting a change of the natural resource by unit: R_1, R_2, R_3, R_4, R_5 under change by unit of resources R_2, R_3, R_4, R_5, R_1 respectively. For example, K_{12} = 0,1 - means that under change (decrease) of resource R_2 by 1 (unit) 1 unit of resource R_1 changes by 0,1. I.e. K_{12} reflects an influence of R_2 dynamics on R_1 etc.

D_1, D_2, D_3, D_4, D_5 are individual components of the natural resources dynamics, including D_1 - dynamics due to natural processes, D_2 - due to resources extraction, D_3 - due to reverse resources consumption, D_4 - due to inter-resources links, and D_5 - due to new methods of assessment.

t_0 is some initial time of estimates. t_1 is some future time with estimates of the natural-resources potential dynamics for a period of (t_0 - t_1). Σ are some generalizations or summary characteristics.

Similar models (Fig. 20, 21) can be made using actual data (real-time indicators), and predicted assessments for various variants of the regional development. On the basis of similar models, the indicators, criteria and limitations can be calculated for variants of the regional nature management corresponding to sustainable nature management and development (Table 13).

Table 13. Indicators, criteria and constrains of the sustainable nature management

Types of indices	Indices, estimates
I Indicators of regional nature management	**1.** Reserves, volumes of natural resources; their qualitative and quantitative characteristics **2.** Volumes of extraction and use of separate kinds of natural resources
II Criteria of sustainable nature management	**1.** Indices of changes, dynamics of separate kinds of natural resources **2.** Balance calculations and estimates **3.** Σ - Δ NRP $\rightarrow$ min (minimization of the natural-resource potential reduction)
III Constrains of sustainable nature management	**1.** ΣR_{dir} (direct resources consumption) $\geq \Sigma R_{rev}$ (reverse resources consumption) **2.** Σ - Δ NRP $\leq \Sigma + \Delta$ NRP **3.** Environmental characteristics $\geq$established standards

According to the matrix models and calculations of indicators, criteria and limitations for sustainable nature management the following scheme for monitoring of regional nature management can be created (Fig. 22).

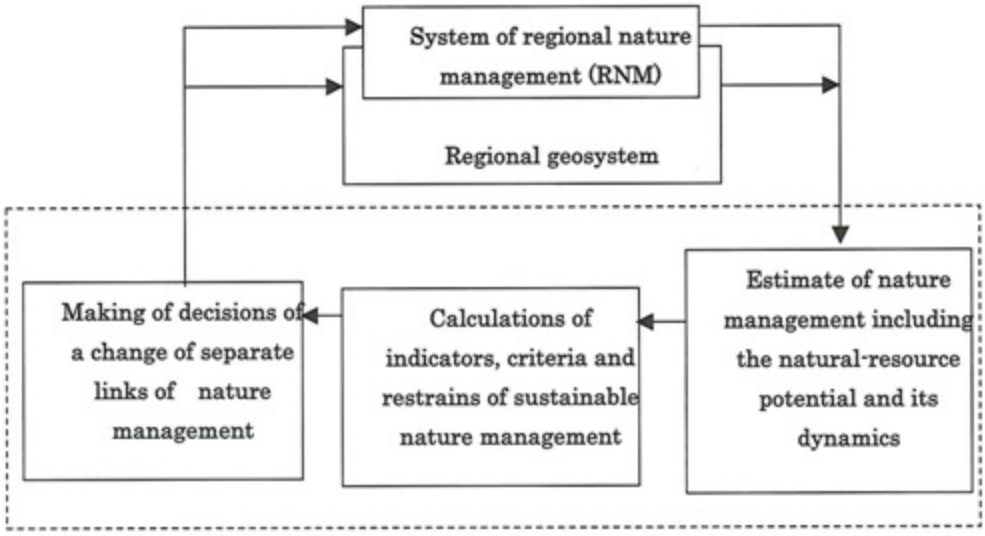


Figure 22. A scheme for monitoring of regional nature management.

Conclusions

1. Amur-Okhotsk region is a large two-tier transboundary geosystem
2. Sustainable development of the Okhotsk region is impossible without the balanced development of the Amur region
3. To ensure the sustainable development of the Amur-Okhotsk region, it is necessary to elaborate a complex international program and to organize an international monitoring

References

1. Baklanov P.Ya. The Far Eastern region of Russia. Problems and preconditions for sustainable development. DalNauka, Vladivostok, 2001. 144 p.
2. Baklanov P.Ya., Ganzey S.S. Frontier and transboundary territories as object of geographical researches // Proceedings of the Russian Academy of Science. Geographical Series. 2004. No. 4, p. 27-34.
3. Baklanov P.Ya., Ganzey S.S., Ermoshin V.V. Natural and economic zoning of transboundary territories // Geography and natural resources Journal. 2005, No. 4. p. 107-114.
4. Baklanov P.Ya., Ganzey S.S., Kachur A.N. Sustainable development of the basin geosystems under conditions of transboundary phenomena // Natural and resources, ecological and social and economic problems of environment in large river basins. Nauka, Media Press, Moscow, 2003. 368 p.
5. Ganzey S.S. Transboundary geo-systems in the south of the Russian Far East and in Northeast China. DalNauka, Vladivostok, 2005. 235 p.
6. Baklanov P.Ya., Arzamastsev I.S., Kachur A.N. et al. Nature management in the coastal zone. DalNauka, Vladivostok, 2003. 251 p.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 1:45pm-2:05pm
Speaker

Sustainable Food Production: Integration of Food, Health and Environmental Challenges

Kalidas Shetty

Professor
Department of Food Science,
University of Massachusetts,
Amherst, U.S.A.
E-mail: kalidas@foodsci.umass.edu

Sustainable development requires us as a global community to capture the opportunities in Life Sciences to solve global problems. To achieve this the world needs a look at Biology as an integrated ecosystem. Therefore, Eco-Evolutionary pressures that drive Biological and Biochemical diversity (as genomes are plastic and adapt) are key to understanding individual Biological systems at the Cellular, Molecular and Biochemical levels. From this basic premise the challenges facing this world must be seen within the global human population trends that is projected to grow from the current 6 billion to 9 billion by 2050 with more people living longer. Another significant challenge that has emerged of late are the Food, Health and Wellness issues with more people excessively (excess calories) nourished than mal (under)-nourished. This has resulted in enhanced disease challenges from chronic obesity-linked diseases at a time many parts of the world are still facing the challenges of infectious diseases from mal-nutrition. Therefore, to understand and solve the sustainable development challenges facing humanity (and in particular food production and quality issues), we need to explore the opportunities and impact of Life Sciences. These opportunities have to be integrated with other technological changes emerging such as in the area of information technology and telecommunications in order enhance quality of life for all people within a sustainable ecosystem. These developments will have to be clearly linked to Environmental consequences of the above challenges and sustainability, with primary challenges coming for energy and water management. For all the above challenges we need an integrated approach (Systems Biology) for problem solving and especially in complex Biological Systems that are oxygen dependent (Redox Biology). These challenges and opportunities have to be seen within the perspective of a global economy and sustainable economic diversification that is bringing in new high growth countries such as India, China and Brazil.

Sustainable Food Production: Integration of Food, Health, Environmental Challenges

Dr. Kalidas Shetty
Professor of Food Biotechnology
Department of Food Science
University of Massachusetts
Amherst, Massachusetts, USA

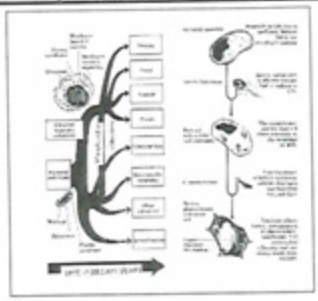
Integration of Redox (Oxygen) Biology as dominant biological systems are driven by oxygen-based energy metabolism

- **Nature of Biological Systems and therefore Life Sciences is Complex from 3 Billion Years of Known Evolution. Harnessing this Knowledge for Technological advances (in Life Sciences) will require better understanding of "Critical Control Points" of Biological Systems for developing "Design" principles for Products, which means better understanding and Integration of Molecular and Metabolic Biology at Systems level ("Systems Biology") and in particular role of Redox (Oxygen) Biology**

Where are the Challenges and Opportunities Based on Global Issues

- **Eco-Evolutionary Pressures** that drive Biological and Biochemical diversity (**genomes are plastic and adapt**) are key to understanding individual Biological systems at the Cellular, Molecular and Biochemical levels.
- This core investigative direction has to take into account
- Current human population trends (8-9 billion by 2050) and **more living longer.**
- **Food, Health and Wellness issues** with more people excessively (excess calories) nourished than mal(under)-nourished .
- Technological and economic evolution, especially impact of **Life Sciences** and **Information Technology** on Quality of Life.
- **Environmental consequences** of the above issues and **sustainability**. **Energy** sources/de-centralization
- and **Fresh Water** conservation/pollution
- **We need an integrated approach (Systems Biology) to problem solving and especially in complex Biological Systems.**

Better Understanding of Cellular Evolution and Organization is Critical-Evolutionary Biology &Specifically Role of Redox Biology



Systems Biology Concept by Kitano

- Kitano, H., 2002-Systems Biology. Science: 295: 1662-1664
- "To understand biology at the systems level we must examine the structure and dynamics of cellular and organismal function, rather than the characteristics of isolated parts of cell or organism"
- " A system level understanding of a biological system can be derived from insights into 4 key properties:

1) Systems Structures: Network of gene interactions and biochemical pathways; mechanisms by which these interactions modulate the physical properties of intracellular and multicellular structures.
2) System Dynamics: System understanding over time through metabolic analysis, biochemical factor responses and sensitivity analysis.
3) Control: Mechanisms that control the state of cell, tissue or organism and prevent malfunction and identify targets of interventions.
4) Design: Construction of biological systems with desired properties dependent less of trial and error and more based on biochemical principles. Stronger concept-linked as well as hypothesis-driven research is key to better design. "

REDOX BIOLOGY IS IMPORTANT TO SUSTAINABILITY OF BIOLOGICAL SYSTEMS & BASIS FOR CRITICAL CONTROL POINT

(Adapted from Bresh and Havre, PNAS 2002: 99,13969)

Sustainable Development Targets

- Agriculture and Food
- Health
- Industrial
- Environmental
- Energy
- Water

Agriculture and Food

Low in put Agriculture

- Improvement of Yields—Photosynthesis/Respiration
- Pest and Pathogen Tolerance/Low Chemicals
- Stress Tolerance/Abiotic
- Nutrient Improvement
- Weed Management

Healthy Food

- Functional Foods
- Food Preservation
- Post-harvest Management
- Waste Remediation
- Novel Ingredients
- Dairy
- Alcoholic Beverages

Health

- Protein Therapies
- RNA interference
- Vaccines
- Small Molecules
- Complex Carbohydrates
- Complex Lipids
- Nutritional Therapies
- ALL targeted for specific diseases

Industrial

- Solvents
- Detergent Proteins
- Enzymes for various applications
- Intermediates for complex synthesis
- Amino acids
- Nucleic acids

Environmental

- Detoxification
- Waste Remediation
- Indoor Pollution Control
- Sanitation
- Water Purification systems

Energy

- Biofuels—Bio-Ethanol
- Biomass-Plant systems
- BioMethane
  BioDiesel

Technologies and Approaches for SUSTAINABLE Product Development

--Concept-driven technology approach

- Science/Concept-driven technology approach
- Need Original Thinking and Creativity
- Need to Think Outside the Box and Outside Normal Approaches
- Biological Complexity requires a "Systems Approach" and this is more complex than Software Development for "Systems Integration" in machinery and many, many times more complex than hardware manufacturing
- Need to consider Evolutionary concepts and Traditional Knowledge to enhance quality of science concepts
- Better integration of Natural and Social sciences to have maximum effect

Complex Biology Technology Platforms

based on Critical Control Points -- CCP

Development of Technology Platforms

Technology Partnerships-National and International

Resource Development and Management

Development and Integration of Value Chain-Complex Integration

Other Critical Needs

- Techniques and Instrumentation to address concepts and develop technologies---Tools to understand at Molecular level to Eco-Systems level and now Nano level
- Integration of Concepts and Technologies
- Interdisciplinary approaches
- Integration of Systems and Molecular Approaches

Focus on Major Global Challenges

- Food, Health and Environmental Challenges
- Water and Energy Challenges
- Downstream and Value-added technologies focused on quality of life and sustainability

Overall Understanding of the World Around Us and World Experiences

Turning
Global dreams
into reality

- Global Technology Assessment and Progress
- Resource and Commercial Geography
- Global Economic Development
- Global Political, Philosophical & Social History
- Challenges Posed by China Brazil, New Russia and India---Rapid Changes and New Models calls for Effective Partnerships (by 2025 55-60% of global GDP would move to Asia)
- Sustainability challenges posed by above

THANK YOU FOR YOUR KIND ATTENTION and HOSPITALITY

"Sathwath Sanjayathe Jnanam"

"True knowledge comes from understanding the essence of existence"

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 2:05pm-2:25pm
Speaker

The Land Use Change in Northeast of China since 1980

Bai Zhang

Director
Northeast Institute of Geography and Agricultural Ecology,
Chinese Academy of Sciences, China
E-mail: zhangbai@neigae.ac.cn

Human-induced changes in land use/cover form an important component of sustainable development research. Therefore, it is important to study land use/cover and its change. Northeast China is one of the main agricultural regions in China, its yield of corn and soybean now accounting for more than 30% and 40% of the nation's total. In the past two decades, Northeast China has suffered dramatic land use change as a result of activities of human beings. These changes led to aggravating loss of water and soil, decrease in soil fertility in the black soil zone of the central part, wetland loss in Sanjiang Plain, desertification and grassland degradation in western part. There were many efforts to analyze climate change, landscape change, and effects of agricultural activities on local environment in Northeast China. Yet quantitative knowledge on changes in land use and in ecosystem services at regional level for the whole area is few. For this reason, three datasets of land use/-cover produced from 1980 and 2000 Landsat satellite images were overlaid in ArcInfo to reveal changes in land use/cover. In addition, this study aims to elucidate the interactive nature between changes in land use/cover caused by human activities and the environment (e.g., climate) in Northeast China in the past two decades.

From 1980 to 2000, according to study results obtained from Landsat images, widespread changes in land use/cover took place in Northeast China. Grassland, marsh, water body and woodland decreased by 9864, 3973, 1367 and 10052 km^2, respectively. By comparison, paddy field, dry famland, and built-up land expanded by 7339, 17193 and 700 km^2, respectively. These changes bore an interactive relationship with the environment, especially climate change. On the one hand, climate warming created a potential environment for grassland and marsh to be changed to farmland as more crops could thrive in the warmer climate, and for dry

farmland to paddy field. On the other hand, the changed surface cover modified the local climate. These changes, in turn, have adversely influenced the local environment by accelerating land degradation in the agro-pastoral belt of western part of Songnen Plain, and exacerbating flooding in the drainage areas of the Songhua River and the Nenjiang River.

International Symposium on Sustainable Development
Hokkaido University
August 9, 2006

The Land Use Change in Northeast of China since 1980

Zhang Bai
© Northeast Institute of Geography and Agricultural Ecology,
Chinese Academy of Sciences
Changchun & Harbin,China
www.neigae.ac.cn

Outline

- Background
- The land use changes
- The trend of land use
- Discussion
- Conclusion

Background

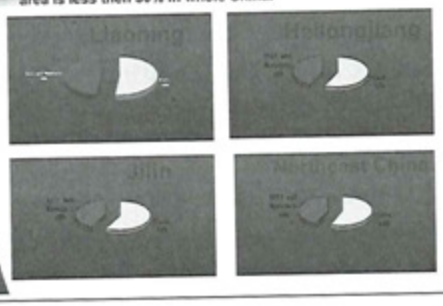
- The Northeast of China is an important farmland, forest,grassland and wetland area which based on the land use feature.
- The Northeast Plain is the largest plain and the famous black soil zone where widely distributes black soil and much fertile soils. Being the most fertile land in China.
- It has been exploited later in China, and the large scale land reclaiming mainly happened in 20th century.
- The larger scale land use change impacting the local ecological environments and the sustainable development deeply.

Background

- Northeast China includes Heilongjiang,Jilin,Liaoning Provinces(800,000 km²)and east part of Inner Mongolia. (440,000 km²).
- The main farming area is in the "Three Provinces".
- The area belongs to the temperature zone.
- The annual precipitation is about from 400 mm in the west to 900 mm along the east coast.
- The basic soils have the meadow soil,black Soil,brown Soil and dark brown Soil from the plain to mountain.

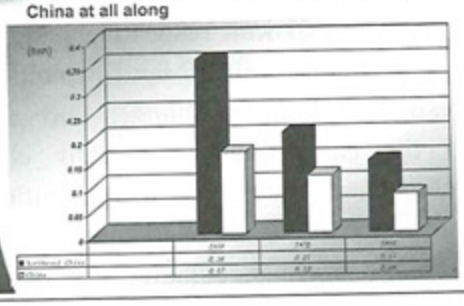
Background --the character of topography

In Northeast of China the plain area is more than 55%,The plain area is less then 30% in whole China.



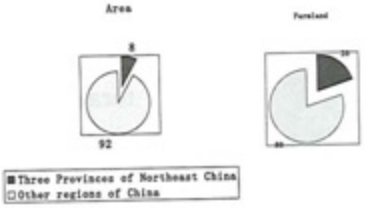
Background

The change of farmland per person from 1950-1990 In Northeast of China is about 2 times of Whole China at all along



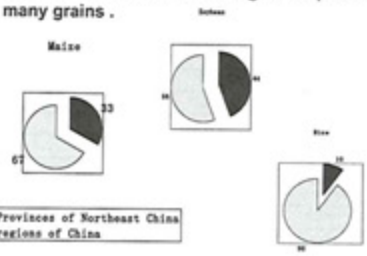
Background

- The main result of land reclaiming is form a important agricultural region .



Background

- The main result of land reclaiming is to produce a great many grains .



Background

- The NE-China provided about 50% of total commercial grain in China every year since 1980.

The land use changes

- The land use information is figured from Landsat satellite images in 1980 and 2000 which is overlaid in GIS to show the changes.
- Meanwhile, the spatial features of regional land use change can be modeled.
- The study aims to analyze the land use changes which caused by human activities and natural waves.It can provide some information for the sustainable development research in the area.

Environmental

- Detoxification
- Waste Remediation
- Indoor Pollution Control
- Sanitation
- Water Purification systems

The land use changes

Land use change of each category from 1980 to 2000

Land use type	1980 (km²)	2000 (km²)	Change km²	Change %	Change %per year
Paddy field	36631	43970	7339	20.04	1.67
Dry land	23933 5	256527	17193	7. 18	0. 63
Forest	359349	349297	-10052	-2. 80	-0. 26
Grassland	59018	49154	-9864	-16. 71	-1. 65
River & lake	25959	24592	-1367	-5. 27	-0. 49
residential area	23666	24367	700	2. 96	0. 27
Wetland	33553	29581	-3973	-11. 84	-1. 14
Unused land	12406	12466	60	0. 48	0. 04

The land use changes

- From 1980 to 2000, the paddy field increased fast. The area of paddy field increased by 7,339km² (20.4%).
- The dry land increased by 17,193 km² (7.2%).
- The grassland decreased from 59,018 km² to 49,154 km²(16.7%).
- Area of wetland, river & lake and forest decreased by 11.8%, 5.3%, and 2.8%.

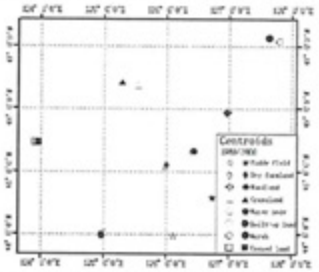
The land use changes

- Through calculated the area-weighted centroids to show the land use temporal changes.
- The movement of spatial distribution was defined as the difference between centroids of each land use type in different periods.

$$X_i = \sum_{i=1}^{n}(C_a \times X_i)/\sum_{i=1}^{n} C_a \qquad Y_i = \sum_{i=1}^{n}(C_a \times Y_i)/\sum_{i=1}^{n} C_a$$

Where X and Y are abscissa and ordinate of all the patches of land use type in different periods, respectively. Ai is the area for patch 'i'. Xi and Yi represent the abscissa and ordinate of the patch 'i'.

The land use changes



Movement of centroids of each land use type in Northeast China from 1980 to 2000

The land use changes

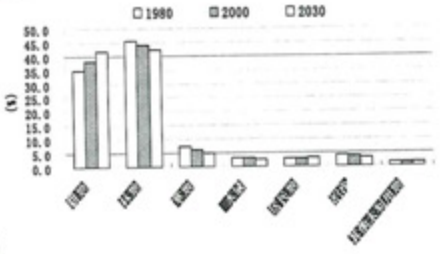
- From 1980 to 2000, the centroid of paddy field move to north-eastward with a distance of 84 km. This was related to the climatic warming trend and the technique development of rice planting in colder northern region.
- The centroid of grassland move to north-westward with a distance of 20 km, which resulted from reclamation of grassland, mainly in Songnen Plain.
- Due to change into farmlands, the centroid of wetland shifted to south-eastward with a distance of 14 km.
- The centroid of dry farmland, residential area, unused land and river & lakes moved about 6 km,5 km, 4 km and 3km.

The trend of land use

The land use trend is predicted which based on the MORKOV model

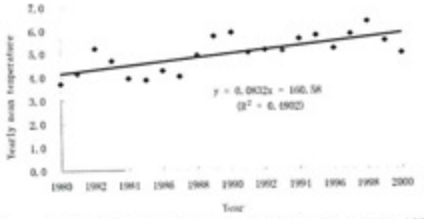
Land use type	Area in 2030 (km^2)	%
Paddy field	50713.07	6.42
Dry land	277816.00	35.17
Forest	334137.50	42.30
Grassland	39976.12	5.06
River & lakes	22196.84	2.81
Residential area	25119.56	3.18
Wetland	25435.53	3.22
Unused land	12006.83	1.52

The trend of land use



Discussion

Natural changes-Climate .....



According to the 49 stations data in NE-China during 1980–2000, the yearly mean temperature showed the rising trend

Discussion

Natural changes-Climate .....

- Associated with this warming trend ,the growing season was prolonged.it enables cultivation of rice in more northern areas than before
- So that a lot of wetland and dry land changed into paddy field in Heilongjiang and Jilin provinces.
- As a result, the wetland and grassland dramatic decreasing in these provinces.

Discussion

Human action-Policy , technology &market...

- Because of the magnitude population in China, the government have to pay the strict attention to the huge food requirement with eco-environmental protection. Under this situation, farmland was increased through reclamation of grassland and wetland year by year.
- After 1980, the maize and soybean were not so profitable as rice in the market.Meanwhile,followed the development of rice planting technology in colder area the paddy field was extended sharply.

Conclusion

- By analyzing the land use change in Northeast of China since 1980, the transitions from grassland into dry land ,dry land and wetland into paddy field are the dominative points.
- Modeling the land use trend in the future, the farmland and residential area are going to increase continuously and the proportion of farmland will reach to 40 % of Northeast China.
- Keeping the adaptive and stable land use is important for sustainable development.

Thanks!

zhangbai@neigae.ac.cn

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 2:40pm-3:00pm
Speaker

An Evaluation of Water Allocation Mechanisms: A Korean Case

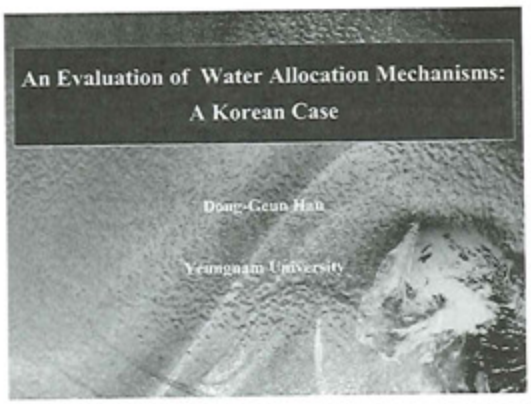
Dong-Geun Han

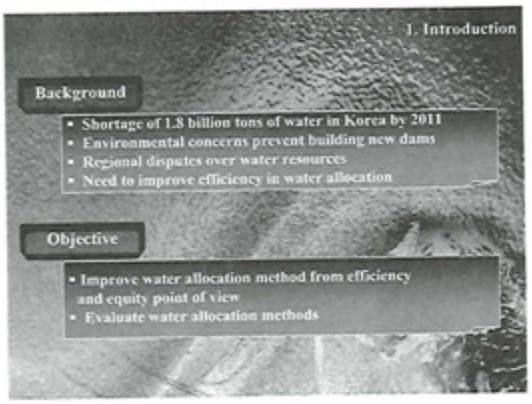
Professor
School of Economics and Finance
Yeungnam University, Korea
E-mail: dghan@ynu.ac.kr

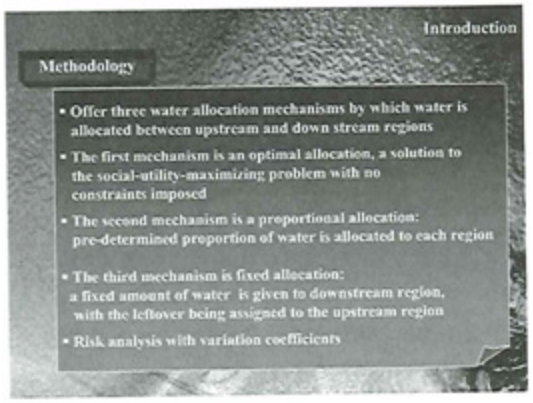
According to a report by UN, Korea is classified as a water-shortage country. Annual total amount of rainfall in Korea may not seem insufficient, but the rainfall concentrates mostly in the monsoon season, and there are considerable deviations among different regions.

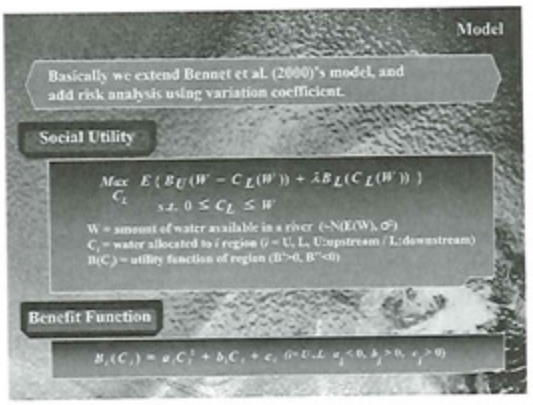
There is a big debate under way about how to deal with the problem. Some people assert that we need to build more dams to store up the rainwater. Others argue that water management needs to be more efficient and that dam construction is not a sustainable approach, only to destruct environment.

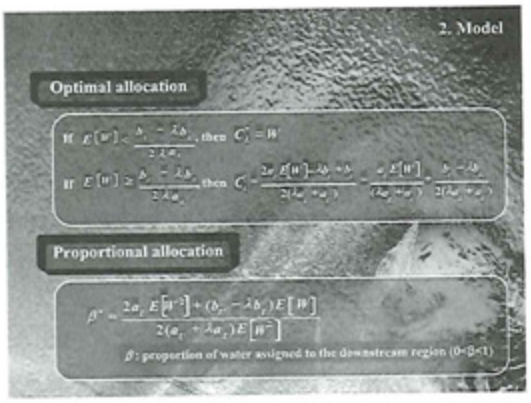
Supporting the demand management approach, my paper is about how to improve the efficiency in allocating scarce water among regions. The study offers two methods of water allocation between upstream and downstream regions; a proportional allocation method and a fixed-amount allocation method. The former method assigns each region with a proportion of the total water available in a river. The latter method allocates a fixed-amount of water to the downstream region, with the leftover being assigned to the upstream region. We apply those methods to Hwang River in Korea and evaluate the performances of each allocation method. This case study shows that, in general, the proportional allocation method is superior from an efficiency point of view, while the fixed-amount method dominates from a risk-equity point of view.

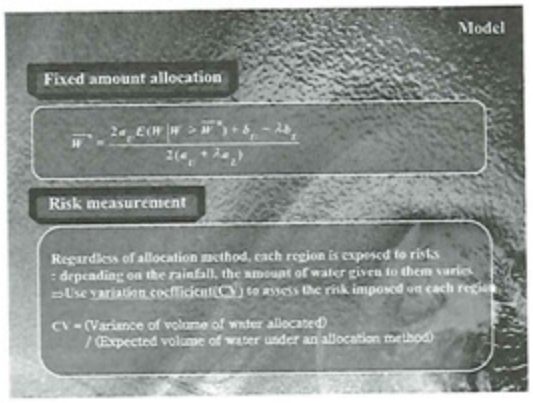

An Evaluation of Water Allocation Mechanisms:
A Korean Case
Dong-Geun Han
Yeungnam University

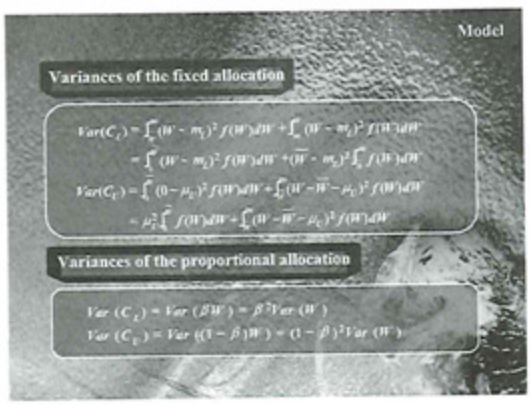

1. Introduction
Background
• Shortage of 1.8 billion tons of water in Korea by 2011
• Environmental concerns prevent building new dams
• Regional disputes over water resources
• Need to improve efficiency in water allocation
Objective
• Improve water allocation method from efficiency and equity point of view
• Evaluate water allocation methods

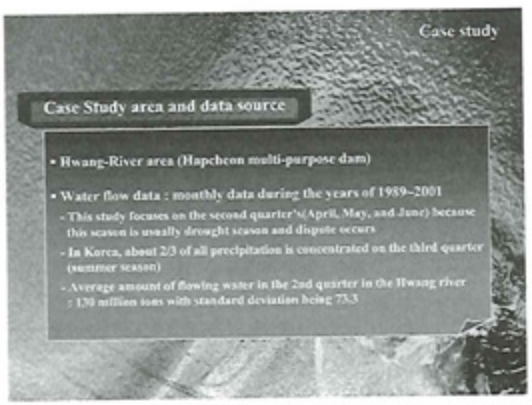

Introduction
Methodology
• Offer three water allocation mechanisms by which water is allocated between upstream and down stream regions
• The first mechanism is an optimal allocation, a solution to the social-utility-maximizing problem with no constraints imposed
• The second mechanism is a proportional allocation: pre-determined proportion of water is allocated to each region
• The third mechanism is fixed allocation: a fixed amount of water is given to downstream region, with the leftover being assigned to the upstream region
• Risk analysis with variation coefficients


Model
Basically we extend Bennet et al. (2000)'s model, and add risk analysis using variation coefficient.
Social Utility
$\underset{C_L}{Max}\ E\{B_U(W-C_L(W))+\lambda B_L(C_L(W))\}$
$s.t.\ 0 \le C_L \le W$
W = amount of water available in a river (~N(E(W), σ²))
C_i = water allocated to i region (i = U, L, U:upstream / L:downstream)
B(C_i) = utility function of region (B'>0, B''<0)
Benefit Function
$B_i(C_i) = a_i C_i^2 + b_i C_i + c_i \quad (i=U,L;\ a_i<0,\ b_i>0,\ c_i>0)$


2. Model
Optimal allocation
If $E[W] \le \frac{b_U-\lambda b_L}{2\lambda a_L}$, then $C_L^* = W$
If $E[W] \ge \frac{b_U-\lambda b_L}{2\lambda a_L}$, then $C_L^* = \frac{2a_U E[W]-\lambda b_L+b_U}{2(\lambda a_L+a_U)} = \frac{a_U E[W]}{(\lambda a_L+a_U)} + \frac{b_U-\lambda b_L}{2(\lambda a_L+a_U)}$
Proportional allocation
$\beta^* = \frac{2a_U E[W^2]+(b_U-\lambda b_L)E[W]}{2(a_U+\lambda a_L)E[W^2]}$
β: proportion of water assigned to the downstream region (0<β<1)

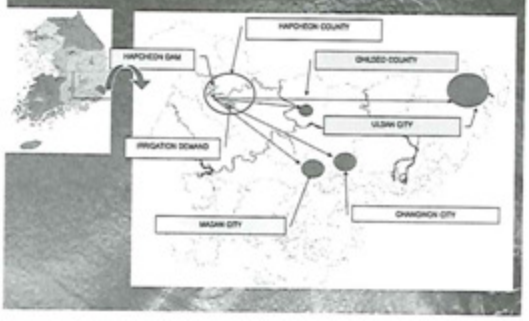

Model
Fixed amount allocation
$\overline{W^*} = \frac{2a_U E(W \mid W > \overline{W^*}) + b_U - \lambda b_L}{2(a_L + \lambda a_L)}$
Risk measurement
Regardless of allocation method, each region is exposed to risks : depending on the rainfall, the amount of water given to them varies
⇒Use variation coefficient(CV) to assess the risk imposed on each region
CV = (Variance of volume of water allocated)
/ (Expected volume of water under an allocation method)


Model
Variances of the fixed allocation
$Var(C_L) = \int_a^{\bar{W}} (W-m_L)^2 f(W)dW + \int_{\bar{W}}^b (\bar{W}-m_L)^2 f(W)dW$
$= \int_a^{\bar{W}} (W-m_L)^2 f(W)dW + (\bar{W}-m_L)^2 \int_{\bar{W}}^b f(W)dW$
$Var(C_U) = \int_a^{\bar{W}} (0-\mu_U)^2 f(W)dW + \int_{\bar{W}}^b (W-\bar{W}-\mu_U)^2 f(W)dW$
$= \mu_U^2 \int_a^{\bar{W}} f(W)dW + \int_{\bar{W}}^b (W-\bar{W}-\mu_U)^2 f(W)dW$
Variances of the proportional allocation
$Var(C_L) = Var(\beta W) = \beta^2 Var(W)$
$Var(C_U) = Var((1-\beta)W) = (1-\beta)^2 Var(W)$


Case study
Case Study area and data source
• Hwang-River area (Hapcheon multi-purpose dam)
• Water flow data : monthly data during the years of 1989~2001
- This study focuses on the second quarter's(April, May, and June) because this season is usually drought season and dispute occurs
- In Korea, about 2/3 of all precipitation is concentrated on the third quarter (summer season)
- Average amount of flowing water in the 2nd quarter in the Hwang river : 130 million tons with standard deviation being 73.3

Case study

Hwang River Basin



Case study

Estimation of benefit Function

- The parameters of benefit function are obtained by the following three terms.
  (1) $B_i(0) = 0$; No consumption means zero benefit.
  (2) $B'(C_i) = 0$; First order condition for benefit maximization.
  (3) $B_i(C_i) = B_i$; C_i, B_i means optimal water consumption and benefit respectively.
- Also we assume that weight(λ) is equal 1, which put same weight for both regions.
- We use Input-Output Table for the estimation of benefit per unit input of water.
- Unit: million won, million tons

Region	Benefit Function
Upstream Region (Irrigation, Chilsea, Hapcheon)	$B_c = -0.13X_c^2 + 2.69X_c$
Downstream Region (Masan-Changwon, Uiuei)	$B_c = -0.12X_c^2 + 28.32X_c$

The result of analysis

Water allocation results by allocation methods

- Water allocation results by each method
  (mean amount of flowing water is 130 mil. tons and standard deviation is 73.3)

Water allocation results and expected benefits

Proportional method				Fixed-amount method				Optimal method			
B^* (%)	Amount of Allocation (Million m³)		Expected benefit (million won)	W^*	Amount of Allocation (Million m³)		Expected benefit (million won)	Amount of Allocation (Million m³)		Expected benefit (million won)	
	Down	Up			Down	Up		Down	Up		
81.9	106.6	23.6	1,670	108	108	22.2	1,673	119	11.2	1,685	

The result of analysis

Simulation

- Data of the second quarter shows severe fluctuation:
  only 26million tons in 1994, one fifth of annual mean volume of flowing water.
- It is difficult to allocate water when available water is short of demand.
  ⇒ make reasonable scenarios based on actual data
  ⇒ find which allocation method is more efficient with respect to expected benefit under various situations.

Hypothetical cases: assumption of mean and standard deviation

Mean volume of flowing water (million tons)	Standard Deviation		
Case 1 : 100	100	75	50
Case 2 : 80	100	75	50
Case 3 : 50	100	75	50

The result of analysis

Allocation results by scenarios

CASE	σ	Proportional method				Fixed amount method				Optimal method			
		(%)	Amount (million m³)		Expected benefit (million won)		Amount (million m³)		Expected benefit (million won)	Amount (million m³)		Expected benefit (million won)	
			Down	Up			Down	Up		Down	Up		
1	100	77.6	78	22	1,493	98	98	2	1,628	100	0	1,632	
	75	84.8	85	15	1,554	94	94	6	1,613	100	0	1,632	
	50	93.0	93	7	1,608	91	91	9	1,597	100	0	1,632	
2	100	77.0	62	18	1,308	91	80	0	1,498	80	0	1,498	
	75	86.1	69	11	1,397	86	80	0	1,498	80	0	1,498	
	50	98.5	78	2	1,484	82	80	0	1,498	80	0	1,498	
3	100	72.5	36	14	992	81	50	0	1,116	50	0	1,116	
	75	83.5	42	8	991	75	50	0	1,116	50	0	1,116	
	50	100	50	0	1,116	70	50	0	1,116	50	0	1,116	

Risk analysis

Variance

CASE	Variance	Allocation type	Value of Variance		
			σ = 100	σ = 75	σ = 50
Mean Streamflow : 100 million m³	$Var(C_A)$	Proportional	529	144	12
		Fixed	3,223	2,001	1,024
	$Var(C_B)$	Proportional	5,929	3,969	2,162
		Fixed	809	663	471
Mean Streamflow : 80 million m³	$Var(C_A)$	Proportional	529	110	1
		Fixed	3,070	1,789	830
	$Var(C_B)$	Proportional	5,909	4,160	2,401
		Fixed	507	523	463
Mean Streamflow : 50 million m³	$Var(C_A)$	Proportional	784	162	-
		Fixed	2,915	1,690	489
	$Var(C_B)$	Proportional	5,256	3,921	2,500
		Fixed	243	238	212

Risk analysis

Coefficient of variation

CASE	Allocation type	Region	Variation(Var)		
			σ = 100	σ = 75	σ = 50
Mean Streamflow : 100 million m³	Proportional	Upstream (A)	76	47	23
		Downstream(B)	24	10	2
	Fixed	Upstream (C)	8	7	5
		Downstream(D)	1,612	334	114
Mean Streamflow : 80 million m³	Proportional	Upstream (A)	96	60	31
		Downstream(B)	28	10	1
	Fixed	Upstream (C)	7	7	6
		Downstream(D)	-	-	-
Mean Streamflow : 50 million m³	Proportional	Upstream (A)	146	93	50
		Downstream(B)	56	20	-
	Fixed	Upstream (C)	5	5	4
		Downstream(D)	-	-	-

Conclusions

Results

- In many cases, the fixed allocation method is superior to the proportional allocation method in efficiency aspect.
- It is intuitively plausible result because the fixed amount allocation method ensures the down stream region, having higher productivity, to have a stable supply of water.
- The proportional allocation, in general, is more equitable than the fixed allocation method
- Tradeoff between efficiency and risk equity

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 3:00pm-3:20pm
Speaker

Challenges and Strategies for the Planning and Design of Sustainable Landscapes

Jack Ahern

Professor and Head
Department of Landscape Architecture and Regional Planning,
University of Massachusetts, Amherst, U.S.A.
E-mail: jfa@larp.umass.edu

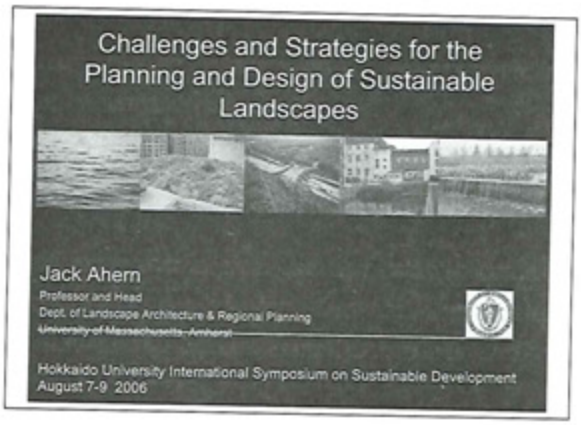
Planning of sustainable environments is a complex process addressing the fundamental triad of economic, environmental and socially-equitable sustainability. This paper discusses challenges and strategies related to the environmental area of the sustainability triad, specifically for determining spatial configurations of landscapes that support physical, biological and cultural processes.

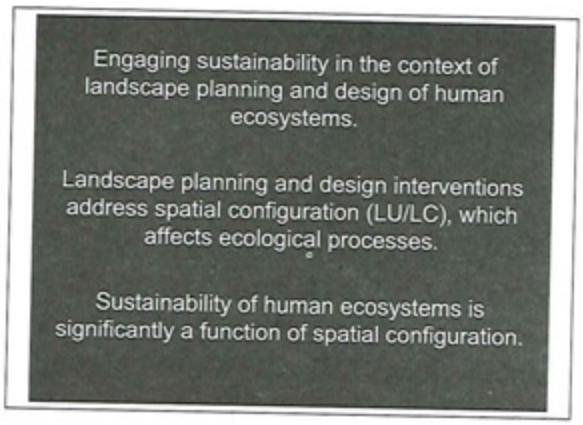
Because sustainable landscape planning addresses a great complexity of natural and cultural resources, a collaborative and interdisciplinary approach is needed. To meet this challenge, a transdisciplinary model of collaboration has been developed in which stakeholders are involved in the planning process with multiple scientific disciplines and professionals. A transdisciplinary approach emphasizes the connection between academic researchers and user groups/stakeholders - with all participants contributing tacit and explicit knowledge, sharing information, and jointly deciding policies and actions. Although this transdisciplinary approach appears obvious and logical, it has yet to be widely practiced in landscape planning.

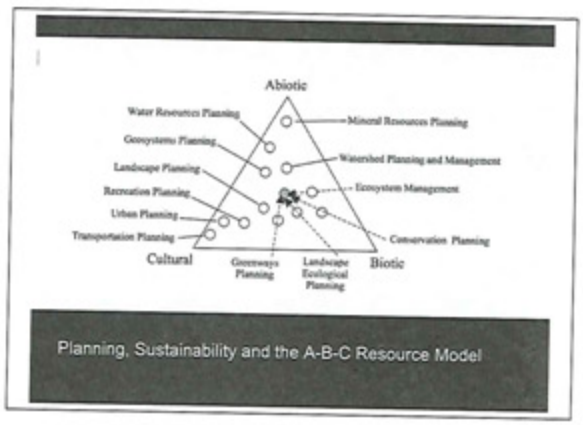
Uncertainty is another major challenge to the understanding of complex landscapes and the testing of innovative policies and recommendations to address sustainability. An adaptive approach to planning defines uncertainty explicitly, minimizes risks, and then proposes actions to "learn by doing" through monitoring, analysis, and revision of plans. While the adaptive approach has been widely used in natural resource management in the USA, it remains a novel, but promissing strategy for sustainable planning.

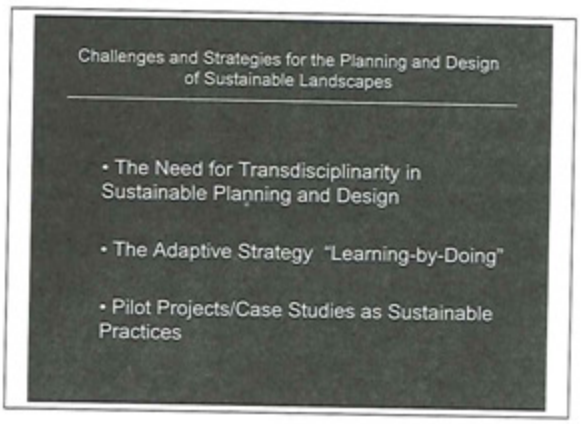
A major challenge to planning sustainable environments is the need to demonstrate through pilot projects what sustainability looks like, how it functions,

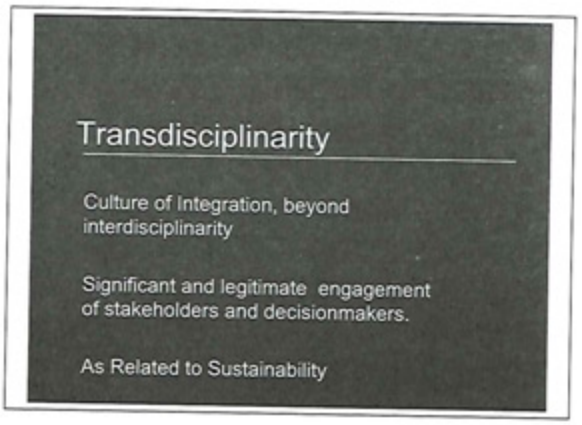
what it costs, and how people respond to it. If sustainability remains only a subject of academic discourse, or abstract governmental policy, it will not change the course of human existence as boldly intended. Pilot projects, from regional plans, to neighborhood districts to individual buildings are all needed to make sustainability a real and tangible model that can be replicated and adapted widely.

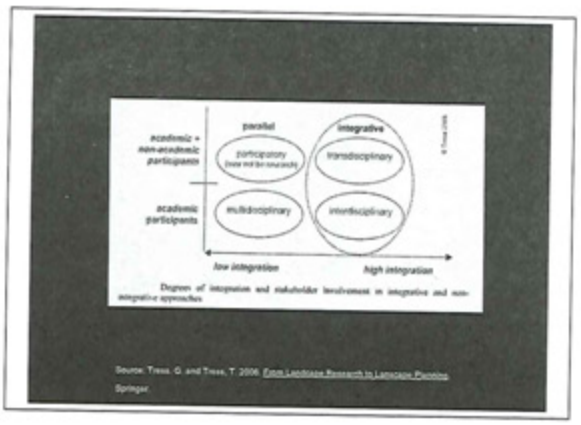


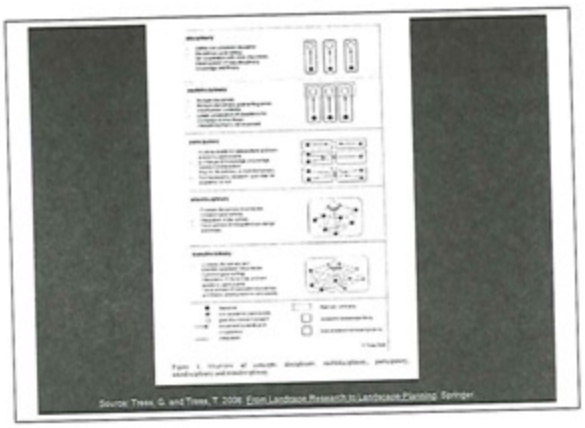












Source: Treib, G. and Treib, T. 2006. From Landscape Research to Landscape Planning. Springer.

Adaptive Planning: *Learning-by-Doing*

- Inherent uncertainty in landscape planning and design
- Imperative to act
- Decisions as experimental probes based on available knowledge
- Monitoring and evaluation is essential
- Managing risks
- Goal: Generation of new knowledge (learning-by-doing)

Schematic steps for an adaptive planning method

10 Principles for Sustainable Landscape Design and Construction

1. Keep healthy sites healthy
2. Heal injured sites
3. Favor living flexible materials
4. Respect the waters of Life
5. Pave less
6. Consider the origin and fate of materials
7. Know the costs of energy over time
8. Celebrate light, respect darkness
9. Quietly defend silence
10. Maintain to sustain

(Thompson and Sorvig, 2000)

Pilot Projects: Manifesting Sustainable Practices in Architecture and Landscape

- Put a "face" on sustainability
- Test new or experimental ideas
- Involve public and experts (transdisciplinary)
- Gain knowledge through monitoring and adaptation
- Projects illustrate application of sustainability principles internationally, at multiple scales and across a range of landscape/urban contexts.

Pilot Projects/Case Studies

- US Green Building Council, LEED Program
- Green Roofs
- Sustainable Urban Communities
- Transportation infrastructure; Ecoduct
- Sustainable Streets
- Florida Greenways Plan

US Green Building Council Leadership in Energy and Environmental Design (LEED)

Goals:

- Define green buildings
- Promote sustainable whole-building practices
- Recognize environmental leadership (rating system)
- Stimulate green competition
- Transform the building market
- Over 1000 LEED-recognized projects (2002)
- Voluntary Program
- Public, Corporate and Private Buildings Eligible

www.usgbc.org

Environmental Impact of Buildings*

65.2% of total U.S. electricity consumption

> 36% of total U.S. primary energy use

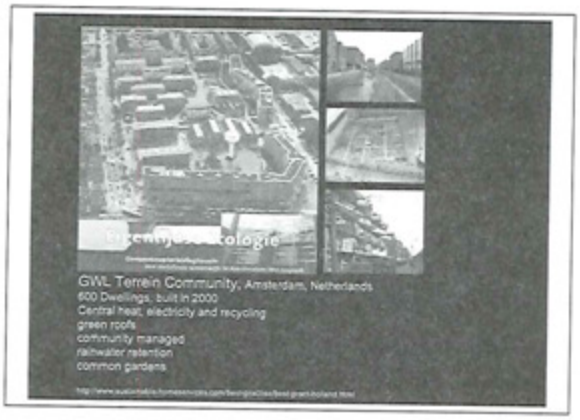
30% of total U.S. greenhouse gas emissions

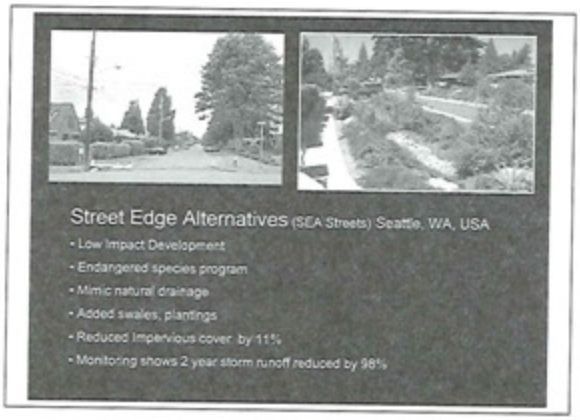
136 million tons of construction and demolition waste in the U.S. (approx. 2.8 lbs/person/day)

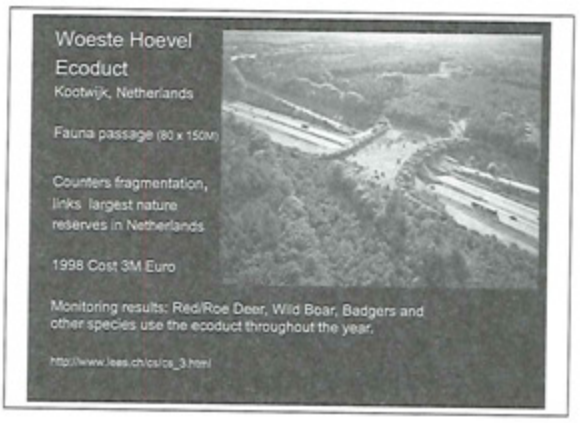
12% of potable water in the U.S.

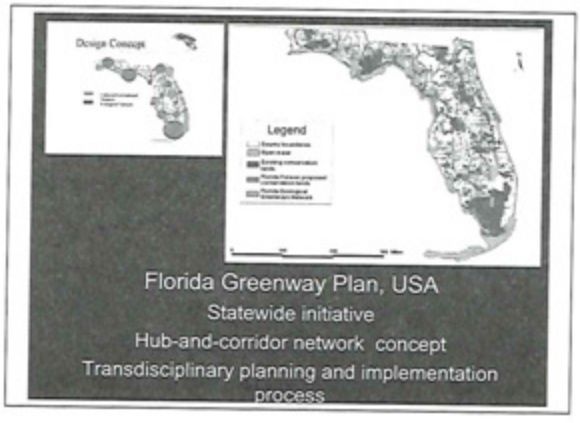
40% (3 billion tons annually) of raw materials use globally

* Commercial and residential Source: US Green Building Council









Summary

How to understand/measure impact of pilot projects on global trends?

Do pilot projects validate the promise of transdisciplinarity?

Can strategic plans and actions influence the drivers of change?

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 3:20pm-3:40pm
Speaker

Creating Effective International Regimes: New Approach of Political Science

Toru Miyamoto

Associate Professor
Graduate School of Public Policy
Hokkaido University
E-mail: toru@juris.hokudai.ac.jp

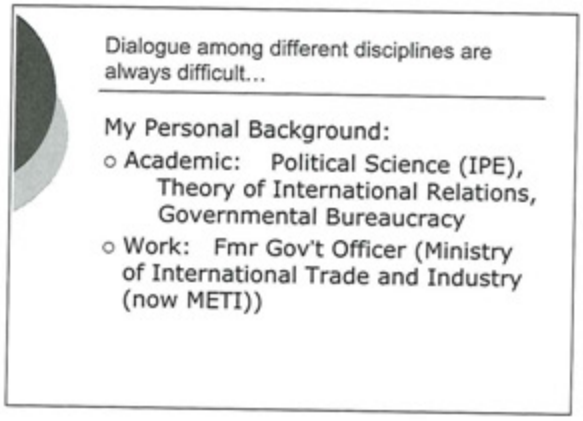
Although the international environmental problems are not new, the creation of regimes for them is relatively new phenomena. This is because we need new science to understand the problem enough to write prescriptions. Therefore scientists play vital roles. But the regime formation is one thing but its implementation is another. Even scientists convince diplomats to agree on multilateral environmental agreements (MEAs), economic activities within borders are difficult to control. Some MEAs are effective in solving the problems, but others are not. We need new approach to design the effective ones.

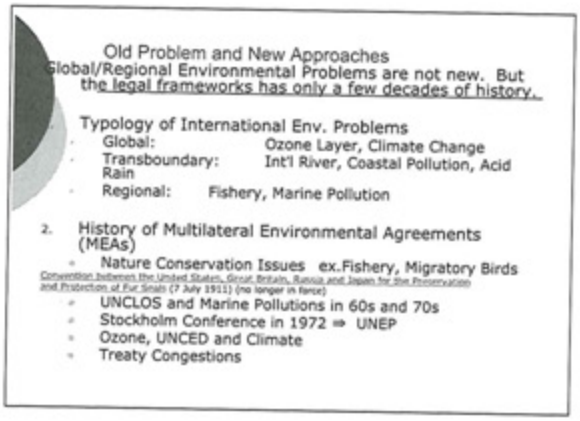
Political scientists have long defined the fundamental character of international relations as chaos. However, researches on the cases found the reality had been much less pessimistic. Scientists share many things such as respect in knowledge, political positions (i.e. in terms of research funding, or free from responsibility to their interest of domestic industries), despite the difference in nationalities. Therefore, networking among them is possible, which often extended to citizen's groups, environmental activists. This network of "enlightened people," often called the "epistemic community" contributes significantly in global/regional regime formation through framing the national interests in new ways.

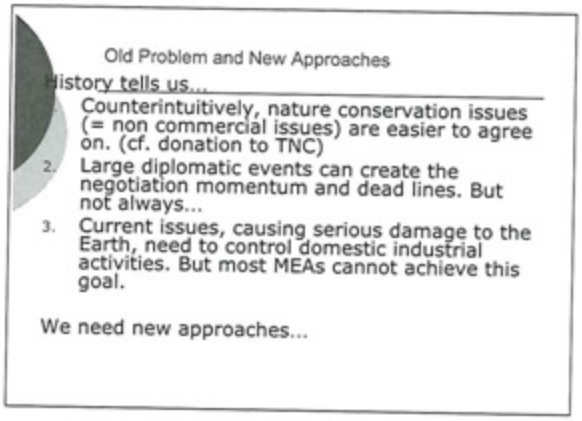
However, now we have "congestion" of MEAs. Only some are effective. Activists advocate they should have "teeth" to harness economic activities within state borders. But this is not easy. Looking precisely at effective MEAs, most of them are originally designed, or later amended to be "self-implementable." Confrontational dialog between activists and practitioners rarely bear fruits. We need three new approaches to inquire the new diplomacy. First is the politics of ideas. National interests are not defined only by material interests. Bearing legitimacy is important

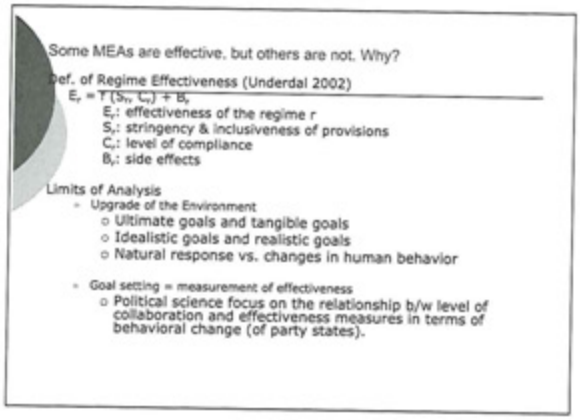
resource for a country to be influential. The second is that we need to consider the domestic decision making process on foreign policy. The third is the politics of regulation. Regulations create costs as well as benefits. Their pay-off structure shapes the politics on their implementation.

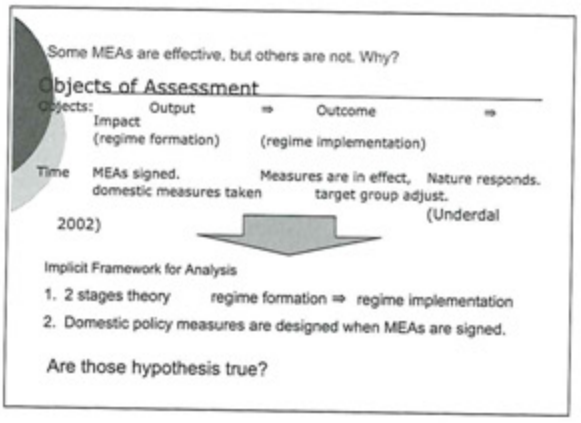
The recognition for the conundrums in the (especially North) East Asia is quite new. But the cold latitudes are fragile. With learning experience, we need action now. Scientists should take the lead.











Rosy Description of Ozone Success

Montreal Protocol

- ~~Scientists (Rowland & Molina) discovered the problem.~~
  - There was great debate on it among scientific community at first.
  - State level regulation on spray cans started before scientists agreed on R&M hypo.
- Scientists and environmental activists formed the "epistemic community" beyond national borders and lead the negotiation.
  - States are only actors in UN system. Scientists' representation are not justified.
  - Industry, government and press played large parts.
- Certain states lead the ideal way.
  - Even US State Dept. was pushed to negotiate.
  - Many diplomats are too busy to learn details of the issues.
- UNEP play the role of catalyst.
  - UNEP has to defend its raison d'etre.
  - UNECD also play a role.
- Industry actors change their behavior swiftly, once they are convinced.
  - Game theory Olson vs. Stigler
  - Regulations that create benefits to be shared by the regulated are self-implementable.
  - Corporate managers got together after the MP was signed and found the implementation solution. (Canan and Reichman 2002)

International Relations in the Post-Modern World

- As states have regular diplomatic relations, negotiators are less likely to deceive others (The more the meetings are regularly held, the more players choose corporative equilibrium.)
- National interests are not the aggregation of material resources. They are largely influenced by the ideas, such as human rights and environment conservation.
- *Idea matters!*

Lessons for the Future

- Scientists play important roles especially at the *early* stage, when awareness raising is the core mission. This may be true in the Northeast Asian region.
- However, designing "self-implementable" regulation is not easy. You need to specify the harmful activity and design the regulation economically viable. Only technologically capable, commercially viable and politically justifiable regulation will be implemented in the world especially without the single sovereignty. Economists as well as corporate actors should be involved in the regulation design process.
- *Don't forget inviting political scientists for your next conferences!*

Regime Formation and Regime Implementation

- Researches on MEAs are mainly interested in regime formation, ~~because regimes formation were the political~~ objective.
- Most of MEAs are still at the early stage of implementation. The recent study on the TEAP shows details of implementation were to be designed on the process of implementation.
- If we take this into our consideration, we should perceive that the regimes are not fully formed when diplomats agree on it. We should understand regimes are supplementary formed on the process of implementation.
- This explanation describes the Kyoto Protocol discussion after 1997 as well as fits properly with the "New Sovereignty" arguments (Chayes & Chayes 1998).
- *Forget 2 steps theory and watch the fact!*

Things be taken Into consideration...

- States are not unitary actors. Look at the decision making process on foreign policy.
- Design regulations to be implemented smoothly. Pay off structure of key players are the key.
- Idea matters.

Hokkaido University International Symposium on Sustainable Development
Plenary Session 3: Wednesday August 9, 2006 / 1:15pm-3:45pm

Summary of Plenary Session 3: Countermeasures for Sustainable Development

Chaired by **Oleg Shcheka**

Department of International Programs and Projects,
Far Eastern Branch of the Russian Academy of Sciences, Russia
E-mail: shcheka@hq.febras.ru

Co-Chaired by **Takayuki Shiraiwa**

Research Institute for Humanity and Nature, Japan
E-mail: shiraiwa@chikyu.ac.jp

Keynote Speaker:
Petr Y. Baklanov, Director, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Russia
Speakers:
Kalidas Shetty, Professor, Department of Food Science, University of Massachusetts, Amherst, U.S.A.
Bai Zhang, Director, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences, China
Dong-Geun Han, Professor, School of Economics and Finance, Yeungnam University, Korea
Jack Ahern, Professor, Department. of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst, U.S.A.
Toru Miyamoto, Associate Professor, Graduate School of Public Policy, Hokkaido University

Prof. P.A. Baklanov defined "a sustainable development of the region" as its stable development during a long period of time (tens of years) in the economic, social and ecological spheres. He discussed "Amur River basin-the Sea of Okhotsk system" and showed various components which we should take into account for the sustainable development of the region. Prof. Zhang Bai presented us recent land-use changes in the Northeast China. Significant land-uses changes are occurring in this region following Chinese policy in the last 20 years. It seems that Russia and China has been developing their own policies but we believe that international involvement is necessary in treating with transboundary ecosystem such as Amur River basin and the Sea of Okhotsk system.

Prof. Kalidas Shetty proposed "System Biology" to solve problems in complex Biological systems. By keeping the idea in mind, Prof. Shetty claimed that evolutionary concepts and traditional knowledge are necessary to enhance quality of science concept.

Prof. Dong-Geun Han reported three different methods in allocating water to Hwang-River area. He concluded that fixed allocation method is superior to the proportional allocation method in efficiency aspect. The proportional allocation method is, however, more equitable than the fixed method.

Prof. Jack Ahern reported strategies for the planning of sustainable landscape. He proposed three steps 1) necessity of transdisciplinarity in planning and design; 2) "Learning-by-Doing" adaptive strategy and 3) pilot project/case studies as sustainable practices.

Finally, Prof. Toru Miyamoto discussed a new political science approach how to create effective international regimes. He claimed that only technologically capable, commercially viable and politically justifiable regulation would be implemented.

Hokkaido University International Symposium on Sustainable Development
Parallel Session 1: Tuesday August 8, 2006

Summary of Parallel Session 1: How to Sustain Agrosphere, Biosphere and Geosphere

Mitsuru Osaki

Director
Sustainability Governance Project (SGP), Hokkaido University
E-mail: mosaki@chem.agr.hokudai.ac.jp

The aim of this symposium was to discuss and find ways to sustain the global environment and ecosystem by addressing worldwide governance issues. The symposium was organized and sponsored by the Sustainability Governance Project (SGP), Hokkaido University, and co-sponsored by 1) 21st Century COE Program "Marine Bio-Manipulation Frontier for Food Production - Toward Advanced and Safe Use of Aquatic Organisms" (Graduate School of Fisheries Science, Hokkaido University), 2) 21st Century COE Program "Prediction and avoidance of an abrupt change in the biogeosphere system" (Graduate School of Environmental Science and Institute of Low temperature Science, Hokkaido University), and 3) Strategic Priority Project "Sustainable and Safe Food Production" (Creative Research Initiative "Sousei"). A total of 15 oral presentations and 82 posters were presented during the symposium.

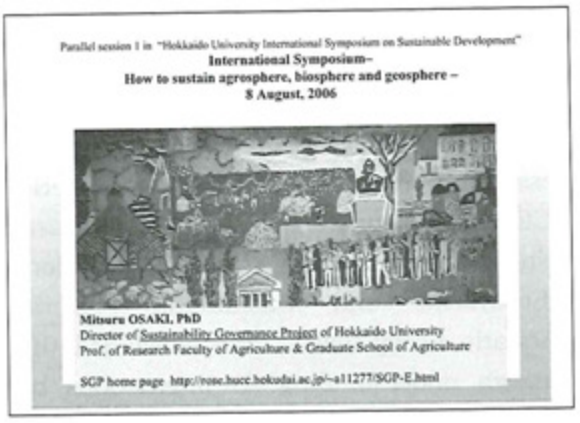
During the first session, we discussed the "Progressive Approach on Sustainable Fisheries Management - Achievements of the 21st Century COE and Future Issues -". We discussed the importance of 3 issues, "Stable Marine-food Products with Increasing Human Population", "Modeling and Field Science in the Ocean Ecosystem" and "Sustainable Fisheries Management based on Adaptive Management in Aquatic Ecosystems". We concluded that sustainable fisheries management is attainable through understanding: 1) interactions between the abiotic environment and organisms, and 2) biodiversity, which is influenced by natural factors and human impacts.

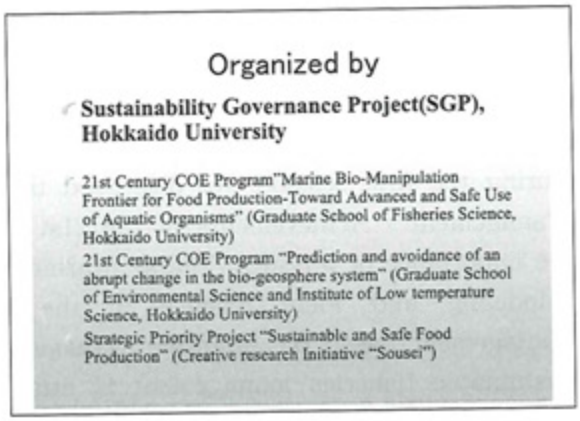
In the second session, the "Roles of the coupled system of biosphere and geosphere" were argued. The need for structures through inter-departmental collaboration was clearly introduced. Feedback with problems such as global warming, biodiversity, water resources, energy, food, health, and population growth development was discussed as "However we try to solve one problem, we often make others worse", indicating that multidisciplinary approaches are required for targeting beyond the Kyoto Protocol. The Hokkaido Model was then shown to the audience. Composed of 3 levels: the fundamental model, the practical model and the governance model, the Hokkaido Model will ultimately be scaled up to become

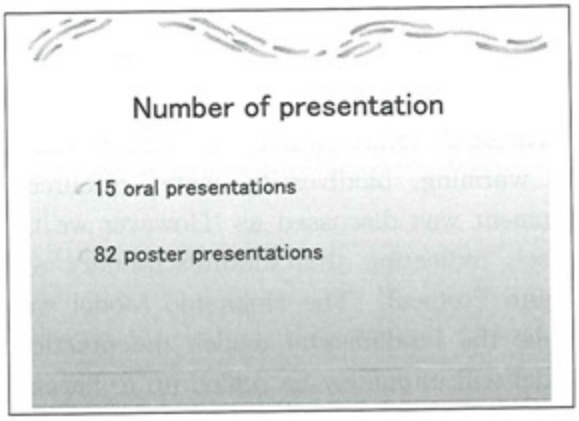
a global model.

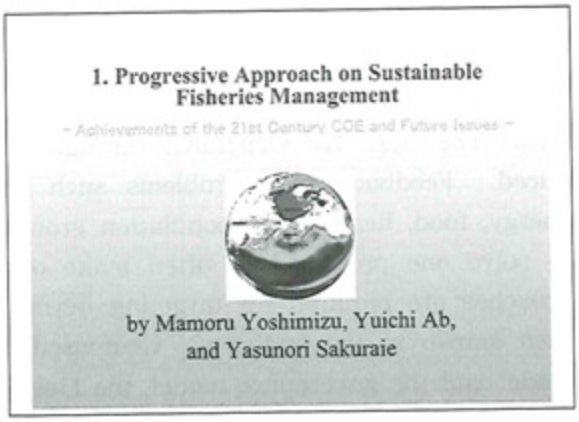
During the third session, the "Sustainability and Security of Food Production" was discussed, focusing on the problems of present agricultural systems. As fossil fuel is currently the engine of modern agriculture, it must eventually switch to bio-products derived from natural ecosystems.

At the fourth session, "Integrative Perspective on the Sustainable Earth" was discussed by sharing information about the Sapporo Nodal Office of Global Land Project, presently being managed by the SGP. The Global Land Project (GLP), the IGBP/IHDP joint-core project succeeding the GCTE and LUCC, was launched this year and is focused on coupled social/natural systems. The thematic foci of the Sapporo Nodal Office include vulnerability, resilience and sustainability targeting on "Northern systems affected by global warming", "Freshwater linkages, Watershed processes", "Modeling ecological-human processes at regional scales", "Southeast Asian restoration and sustainable management", and "Training, education and capacity building in Southeast Asia".



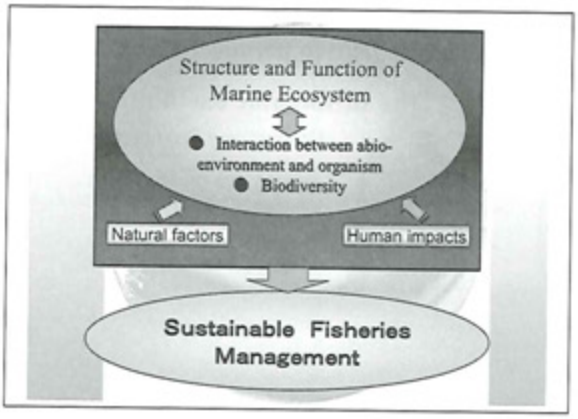






Sustainable Fisheries Management as Fisheries & Ocean Sustainability Science

1. Stable Marine-food Product with Increase in Human Population
   - Creating "Safe and Worry-Free" salmon products using a HACCP system from fishing through processing to distribution (H. Kasai & M. Yoshimizu)
2. Modeling and Field Science in the Ocean Ecosystem
   - Development of an integrated ocean model for understanding changes in ecosystem in the western North Pacific associated with global warming (Y. Yamanaka)
3. Sustainable Fisheries Management based on Adaptive Management in Aquatic Ecosystem
   - Genetic approach to management and sustainable use of marine bio-resources (S. Abo, M. Yoon & N. Azuma)
   - The Shiretoko World Natural Heritage including marine and land ecosystems: towards coexistence with marine diverse and fisheries (Y. Sakurai & M. Kaeriyama)

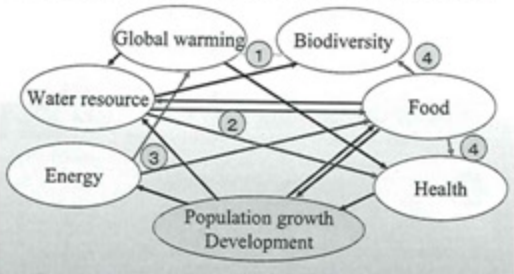


2. Roles of the coulpled system of biosphere and geosphere

by Yasuhiro Yamanaka, Takeshi Nakatsuka, Toshihiko Hara, and Motoyoshi Ikeda

Structures with Efforts through Inter-departmental Collaboration

Feedback with problems Beyond Kyoto Protocol



However, we try to solve one problem, but often make others worse.

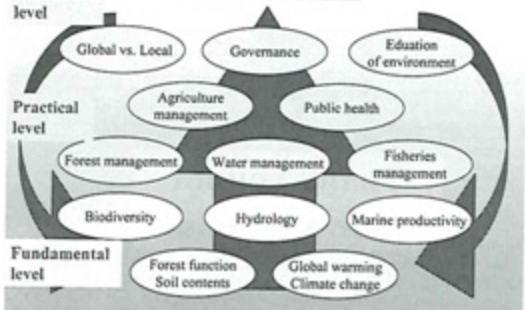
(1) Tree with higher carbon fixation → Lower biodiversity

(2) More food, Water resource → Saline soil, Health problem → Less food

(3) Oil price up → Ethanol from soybean and corn → Food price up, Forest destruct

(4) Genetic engineering for food production → Lower biodiversity, Health concern

Hokkaido Model
scaled up to global model



3. Sustainability and Security of Food Production

Dr. Zhang (China): Soil quality evaluation and sustainable agriculture development in the region of southwest part of China-Yunnan Province

Dr. Rashid (Bangladesh): Arsenic Contamination of Groundwater: Food Safety and Human Health Hazard in Bangladesh

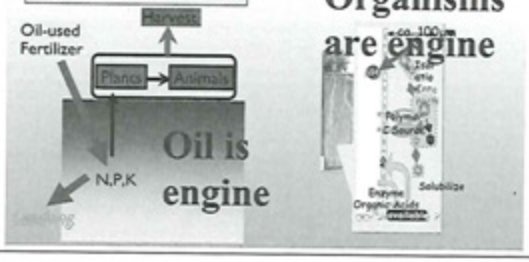
Dr. Koyama (Japan): Improvement of P uptake from acid soil by transgenic plants with modified citrate metabolism

Dr. Tawaraya (Japan): Mycorrhizal fungi in the tropical rain forest of Indonesia and its utilization for reforestation

Problems of Resent Agricultural System

Input of excess amount of fertilizer: Serious consequences on the environment

Iternative agriculture



4. Integrative perspective on the sustainable earth

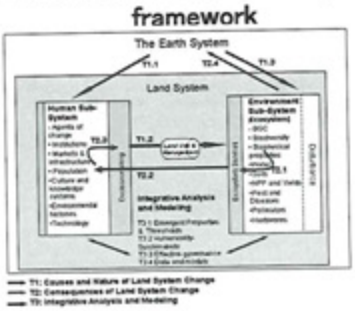
Global Land Project (GLP)

joint IGBP/IHDP core project succeeding GCTE and LUCC launched in this year

focusing on coupled social/natural systems

By He-Qing Huang and Billie Turner
+Kensuke Fukushi

Global Land Project conceptual framework



Sapporo office structure

Integrated Research System for Sustainability Science(IR3S)

NC-GLP

Hokkaido University

Sustainability Governance Project (SGP)

JAXA

monitoring

Sapporo Nodal Office
Global Land Project

Initiative for Sustainable Development (HUISD)

JICA

capacity building

SSC/IPO GLP

Thematic foci of Sapporo Office

Vulnerability, resilience and sustainability

- Northern systems affected by global warming
- Freshwater linkage, watershed processes
- Modeling ecological-human processes at regional scales
- Southeast Asia restoration and sustainable management
- Training, education and capacity building in Southeast Asia

Hokkaido University International Symposium on Sustainable Development
Parallel Session 2: Tuesday August 8, 2006

Summary of Parallel Session 2: Protection of Society from Infectious Threat

Hiroshi Kida

Director
Research Center for Zoonosis Control, Hokkaido University
E-mail: kida@vetmed.hokudai.ac.jp

The aim of the symposium is to discuss and to find the way how to control emerging zoonoses such as Influenza, SARS, Ebola virus infection, Flavivirus infection, Tuberculosis, Trypanosomiases, Echinococcosis, and Prion diseases.

Excellent presentations on the ecology, natural history, and prediction of antigenic variation, prevention and control of emerging zoonoses were given by Drs. R.G. Webster (St. Jude Children's Research Hospital, USA), K. Ito (Hokkaido University), G.C. Telling (University of Kentucky, USA), Y. Suzuki (Hokkaido University), L.-F. Wang (CSIRO Animal Heath Laboratories, Australia), K. Morita (Nagasaki University), A. Takada (Hokkaido University), T. Romig (University of Hohenheim, Germany), and C. Sugimoto (Hokkaido University).

The conclusion of the symposium is that in order to protect society from infectious diseases and to achieve sustainable society, intensive research and education on the following points are essential;

1. To clarify the ecology of infectious agents in nature
2. Prediction of and preparedness for emerging zoonoses
3. Development of novel methods of early and rapid diagnosis of zoonoses
4. Global surveillance of zoonoses under the international collaboration

Parallel session 2

The 10th International Symposium for Zoonosis Control -Protection of Society from Infectious Threat-

Organized by
21st Century COE Program "Program of Excellence for Zoonosis Control"
Hokkaido University Research Center for Zoonosis Control

Date: August 8, 2006 9:30 -17:35
Venue: Conference Hall, Hokkaido University

Aim of the symposium: *How to control emerging zoonoses*

such as *Influenza, SARS, Ebola virus infection, Flavivirus infection, Tuberculosis, Trypanosomiases, Echinococcosis, and Prion diseases.*

Excellent presentations on the ecology of pathogen, prediction of antigenic variation of human influenza viruses, prevention and control of emerging zoonoses were given by

- ***Dr. R.G. Webster*** *(St. Jude Children's Research Hospital, USA)*
- ***Dr. K. Ito*** *(Hokkaido University)*
- ***Dr. G.C. Telling*** *(University of Kentucky, USA)*
- ***Dr. Y. Suzuki*** *(Hokkaido University)*
- ***Dr. L.-F. Wang*** *(CSIRO Animal Heath Laboratories, Australia)*
- ***Dr. K. Morita*** *(Nagasaki University)*
- ***Dr. A. Takada*** *(Hokkaido University)*
- ***Dr. T. Romig*** *(University of Hohenheim, Germany)*
- ***Dr. C. Sugimoto*** *(Hokkaido University)*

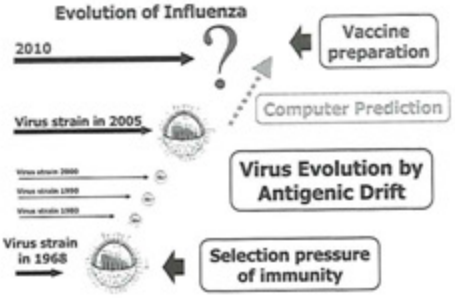
by Dr. R.G. Webster

H5N1: Pandemic Outlook

- It is extremely difficult for humans to be infected
- People cannot contact H5N1 from cooked poultry
- The healthcare industry would be running beyond surge capacity
- If there is a cytokine storm pregnant women and 15-40 year olds would be hardest hit
- Urgent need to increase influenza vaccine manufacturing capacity

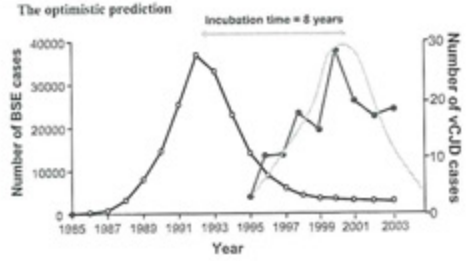
by Dr. K. Ito

A Proactive Control Strategy for Influenza



by Dr. G.C. Telling

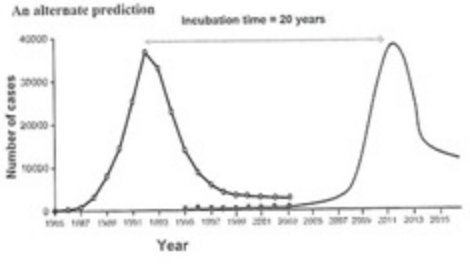
BSE and vCJD: What will happen?



Around 200 cases in total and disease will virtually disappear by year 2010

by Dr. G.C. Telling

BSE and vCJD: What will happen?



Disease has not begun yet.
The few cases so far are just part of the noise of people infected before the BSE epidemic

by Dr. Y. Suzuki

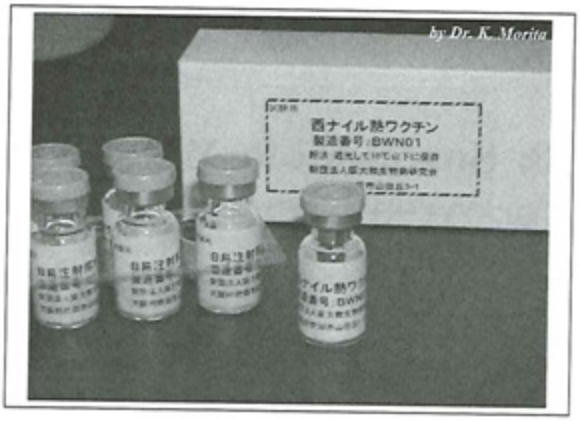
Conclusions

1. Early diagnosis, Early treatment
   > Rapid diagnostic test for TB
   >> LAMP method can contribute to rapid detection of tubercle bacilli
2. Prevention of spread of drug resistant TB
   > Rapid detection test for drug resistance
   >> Gene diagnosis may be the best choice
3. Clarification of spread route
   > Molecular typing of tubercle bacilli
   >> Digitalized methods can provide globally compatible data

by Dr. L.-F. Wang

Bats Are Natural Reservoirs of SARS-Like Coronaviruses

Severe acute respiratory syndrome coronavirus-like virus in Chinese horseshoe bats



by Dr. A. Takada

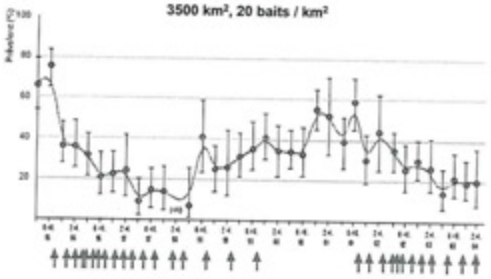
Natural reservoir of filoviruses?

Zambia
- Politically stable
- Close to DR Congo and Angola
- Collaboration with University of Zambia
- Relation through JICA

by Dr. T. Romig

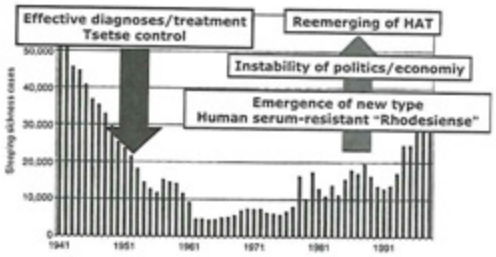
E. multilocularis **prevalence in foxes during and after baiting campaigns with praziquantel (Droncit®)**

3500 km², 20 baits / km²



by Dr. C. Sugimoto

Number of Human African Trypanosomiasis patients (WHO)



To protect society from infectious diseases and to achieve sustainable society, research and education on the following points are highly important:

- *Prediction of the emergence of infections*
- *Clarify the ecology of infectious agents in nature*
- *Preparedness for emerging zoonoses*
- *Development of novel methods of early and rapid diagnosis*
- *Global surveillance of zoonoses under the International Colaboration*

— Protection of Society from Infectious Threat —

Hokkaido University International Symposium on Sustainable Development
Parallel Session 3: Tuesday August 8, 2006

Summary of Parallel Session 3: Sustainable Metabolic System of Water and Waste for Area-Based Society

Yoshimasa Watanabe

Professor
Graduate School of Engineering, Hokkaido University
E-mail: yoshiw@eng.hokudai.ac.jp

The parallel session 3-1 "Innovation of Membrane Technology for Water and Wastewater Treatment (IMTEC)" and 3-2 "Strategy for Sustainable Solid Waste Management (SSSWM)" are organized by the 21st Century COE Program "Sustainable Metabolic System of Water and Waste for Area-based Society".

Group 1. Innovation of Membrane Technology for Water and Wastewater Treatment -IMTEC Sapporo-

IMTEC invited 7 speakers as well as 7 nominated discussers from 9 countries including Japan to be carried out in a Speaker-versus-Discusser Format. Those speakers and discussers developed lively discussions on the recent advances in innovation and integration of membrane filtration and the state of the art and future developments of membrane technology applying to water and wastewater treatment. The new format was well received and the IMTEC achieved a successful outcome.

Group 2. Strategy for Sustainable Solid Waste Management

SSSWM had 3 invited speakers from Austria, USA and Korea. They talked for 1 hour each about the sustainable management of waste and resource. The final phase of SSSWM was a panel discussion with those 3 guests and all participants engaged in a heated debate.
IMTEC and SSSW gained 295 participants in total.

Report from Parallel Session 3:

Innovation of Membrane Technology for Water and Wastewater Treatment

Yoshimasa Watanabe
Graduate School of Engineering

Innovation of Membrane Technology for Water and Wastewater Treatment

—IMTEC Sapporo— Place: Hotel Royton Sapporo, Japan
http://www.cwater.eng.hokudai.ac.jp/english/29_royto.html
Date: August 8 Tuesday 2006

FREE

Yoshimasa Watanabe
Hokkaido University

Keynote address

RECENT ADVANCES IN INNOVATION OF MEMBRANE AND INTEGRATION OF MEMBRANE FILTRATION SYSTEM

PATICIPANTS

WATER	:196
WASTE	: 99
TOTAL	:295

AIM OF THE WORKSHOP

The Sustainable Water Metabolic Systems Group has achieved considerable results under the 21st Century COE Program "Sustainable Metabolic System of Water and Waste for Area-based Society". The major aims of this workshop are to publicize our accomplishments, and at the same time, to bring together a number of selected experts on membrane technology from around the world to share information and knowledge about problems, current status and a future trend of membrane technology through a thorough discussion.

SIGNIFICANCE OF "MEMBRANE"

The Japanese 3rd Science and Technology Basic Plan that has started in April 2006, advocates that we should "achieve a healthy water metabolism and sustainable use of water" in its policy. In the policy, "membrane technology" is recognized as one of the most important leading-edge technologies for water treatment that can be widely used throughout the world.

WORKSHOP STYLE

The program of the workshop consists of counterargument, one-on-one debate and all-round discussion. A Speaker will give a presentation for 25 minutes first. After each presentation, his/her nominated discusser will give the 10 minutes of counterargument. In the following 10 minutes, the speaker and Discusser will develop the one-on-one discussion. Finally other participants will join the discussion in the last 5 minutes. Your active participation to the discussion will be encouraged.

Track for Wastewater

SESSION MODERATORS

Kazuo Yamamoto
The University of Tokyo
Japan

SPEAKERS

Eiy Leong Ong
National University of Singapore
Singapore

"Performance of Pre-denitrification Submerged Membrane Bioreactor (MBR) under various Solid Retention Times"

Rajor Ben Aim
INSA Toulouse
France

"An Approach towards a Better Understanding of Fouling Phenomena in MBR"

Satoshi Okubo
Hokkaido University
Japan

"Membrane Biofouling in the MBR Treating Domestic Wastewater: Identification of Key Players in Membrane Biofouling"

DISCUSSERS

Hong-Sik Shin
KAIST
Korea

"Effect of SRT on Membrane Fouling and Performance"

Dae-Jong Lee
National Taiwan University
Taiwan

"An Alternative Approach towards a Better understanding of Fouling Phenomena in MBR"

Guang-Hao Chen
Hong Kong University of Science & Technology
Hong Kong

"Is Biofilm Formation The Key Player in MBR Biofouling?"

Track for Drinking Water I

SESSION MODERATORS

Shin-ichi Nakasa
The University of Tokyo
Japan

SPEAKERS

Mark R. Wiesner
Duke University
USA

"Nanomaterials and Membranes for Water and Wastewater Treatment"

Katsuki Kimura
Hokkaido University
Japan

"Mechanism involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membranes used for Water Treatment"

DISCUSSERS

Yoshihiko Matsui
Hokkaido University
Japan

"Nanosized Materials in Membrane Applications"

Gary Amy
UNESCO-IHE
The Netherlands

Discussion of "Mechanism involved in the Evolution of Irreversible Fouling in Microfiltration (MF) and Ultrafiltration (UF) Membrane used For Water Treatment"

Track for Drinking Water II

SESSION MODERATORS

Yoshimasa Watanabe
Hokkaido University
Japan

SPEAKERS

Chihpin Huang
National Chiao Tung University
Taiwan

"Recovery of Spent Filter Backwash Water Using Coagulation-Assisted Membrane Filtration"

Stefan Panglisch
IWW Water Centre
Germany

"Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Development"

DISCUSSERS

Se-Ryong Chun
Hokkaido University
Japan

Discussion for "Recovery of Spent Backwash Water Using Coagulation-Assisted Membrane Filtration"

Chang-Hak Lee
Seoul National University
Korea

Comment on "Low Pressure Membrane Filtration for Drinking Water Production in Germany : State of the Art and Future Development"

Developments/Findings Reported

- Recent Advances in Innovation and Integration
  - Hybrid Coagulation-Microfiltration System
  - (Monolith) Ceramic Membrane Filtration with Pre-Coagulation
  - Flocculation within Membrane Channels
  - Other Hybrids: Powdered Activated Carbon; Biological Oxidation
- Membrane Bioreactors (MBRs)
  - Role of Biofilm vs Feedwater Components in MBR Fouling
  - Effects of Operational Conditions on Performance and Fouling
  - Different Microbiological Communities Responsible for Biofilm Formation versus Foulant "Scavenging"
  - Differentiation of Fiber versus Bundle Fouling
  - Need for Common Terminology and Methods to Assess MBR Performance and Fouling
- Membrane Fouling in Cleaning
  - Chemical Identity of Foulant(s) Revealed
  - New Fouling Mechanism(s) Hypothesized
  - Synergy of Hydraulic (Backwashing) and Chemical Cleaning

Developments/Findings Reported – cont.

- Nanomaterials and Membranes
  - Ceramic Membranes
  - Particle Templating
  - Reactive Membranes (e.g., Oxidation)
  - Nanoparticle Adsorbents (e.g., Microground Powdered Act. Carbon)
- Sidestream (e.g., Filter Backwash Water) Treatment
  - Novel Coagulation-Microfiltration Approach
  - Removal of Supra- and Sub-Micron Particles
  - Solid Phase (Sludge) as Final Membrane Residual
- State of the Art and Future Developments
  - Rapid Growth of Membrane Technology in Germany
  - Emphasis on Low Pressure (Polymeric) Membranes
  - Emerging Interest in Ceramic Membranes
  - Unit Costs Decreasing (e.g., €0.10/m³) Approaching Conv. Treatment
  - New Interest in High Pressure Membranes for Xenobiotics
  - Issue: Pretreatment

Strategy for Sustainable Solid Waste Management

Date: 13:30-17:30, August 8, 2006
Place: Hotel Royton Sapporo

Program

13:30-Opening

Professor Toshihiko Matsuto
Graduate School of Engineering, Hokkaido University

13:40-14:40
Waste management, an integrated part of sustainable resource management
Professor Paul H. Brunner
Institute for Water Quality, Resource and Waste Management
Vienna University of Technology

14:40-15:40
Sustainable Land Disposal: Definitions and Possible Approaches
Dr. Luis F. Diaz
President, CalRecovery, Inc.
Editor in Chief, Waste Management

16:00-17:00
Integrated Strategy of Recycling in Korea
Professor Dong-Hoon Lee
Department of Environmental Engineering, College of Urban Science
Director of Center for Biowaste Recycling Research
Director of Industry-Academy Cooperation Foundation, The University of Seoul

17:30- Panel Discussion

Summary of Plenary Session 4: "Summary of the Symposium"

Takeo Hondoh

Global Manager
Hokkaido University Initiative for Sustainable Development (HUISD)
E-mail: hnd@lowtem.hokudai.ac.jp

Report from Parallel Session 1.
---Mitsuru Osaki, Sustainability Governance Project (SGP), Hokkaido University
Report from Parallel Session 2.
---Hiroshi Kida, Research Center for Zoonosis Control, Hokkaido University
Report from Parallel Session 3.
---Yoshimasa Watanabe, Graduate School of Engineering, Hokkaido University
Closing Remarks: *For Our Future Direction*
---Takeo Hondoh, Hokkaido University Initiative for Sustainable Development (HUISD)

Throughout this symposium, we aimed to stimulate and to deepen discussions among researchers of various fields relating to sustainable development in order to enhance understanding our challenges from various viewpoints on sustainability and to surmount potential barriers between different disciplines, different nations and different regions.

We thank that more than 900 participants in total including 80 overseas participants from 19 different countries joined the symposium. Also we had a number of researchers from various disciplines such as eco-system, governance, recycle economy, water management, etc. These were the reasons why the discussion became active and thoughtful.

This symposium featured the three-day program to address and to integrate the sustainable development issue both the inter-disciplines and specific fields; Day-1 "Four plenary sessions on comprehensive view of sustainable development", Day-2 "Three parallel sessions on different disciplines", and Day-3 "Plenary sessions on roles of higher education and countermeasures for sustainable development" including poster presentations. Comprehensive summaries provided by the chairpersons of these sessions are included in this volume.

With a integrated discussion, the symposium reached the conclusion for the realization of need of solid network/collaboration, which is highly needed, among universities, institutions

and individual researchers, in which the organizer of the symposium declared that Hokkaido University is willing to provide a comprehensive network for information-exchange on sustainable development and to organize next symposium in Sapporo in 2009 to continue and develop the discussion raised by this symposium. Coming Hokkaido University's activities on sustainable development will be informed to all participants immediately after the concrete plan is confirmed.

Thank you again to all your sincere supports to the symposium.
Hope to see you again at Sapporo on summer 2009!

Poster Abstracts

P-1

Research Activities on Environmental Studies in the Pan-Okhotsk Research Center

Naoto Ebuchi, Yasushi Fujiyoshi, Toshihiko Hara, Sumito Matoba, Humio Mitsudera, Tomohiro Nakamura, Takeshi Nakatsuka, Kay I. Ohshima, Takayuki Shiraiwa, Kunio Shirasawa

Pan-Okhotsk Research Center, Institute of Low of Temperature Science, Hokkaido University,

This poster introduces research activities concerning environmental studies in the Pan-Okhotsk Research Center, Institute of Low Temperature Science, Hokkaido University.

The Sea of Okhotsk is one of the southernmost seasonal sea ice zone in the Northern Hemisphere. Thus, it is expected that the generation of sea ice in the Sea of Okhotsk is very sensitive to the global environmental changes, such as global warming. Aiming to properly evaluate role of the Sea of Okhotsk in the global environment, the Pan-Okhotsk Research Center (PORC) was inaugurated in the Institute of Low Temperature Science, Hokkaido University in April 2004.

The Center covers physical, chemical and biological aspects of the environment in the Sea of Okhotsk and its surrounding areas. Field observations and monitoring have been conducted using various instruments, such as the dynamic monitoring system for sea ice areas, which enables simultaneous observations of the oceanic currents, sea ice drift and atmospheric circulation above the ice-covered sea, unmanned meteorological monitoring towers, and research vessels.

Moreover, researchers at the center have been developing numerical models of the Atmosphere- Ocean-Land-Biosphere-Cryosphere system to clarify physical, chemical, and biological mechanisms of the environmental variations in the Pan-Okhotsk area and to predict them.

Properly evaluating the impact of and predicting the future of climate change require conducting intensive observations and developing predictive models based on the collected data. Moreover, the establishment of observation and research networks is also indispensable for continuing long-term, extensive observations.

This Center has been proceeding with comprehensive monitoring and modeling efforts for the Pan-Okhotsk region in collaboration with universities and research institutions not only in Japan, but also in Russia, Canada, the U.S., China, Korea, and numerous other nations.

P-2, 3

International Antarctic Institute project in Hokkaido University

Takeo Hondoh [1], Shin Sugiyama [1], Shigeru Aoki [1], Masanobu Yamamoto [2], Testuo Sueyoshi [1], Sohey Nihashi [1], Hiromi Kimura [1],

1/Institute of Low of Temperature Science, Hokkaido University,

2/Faculty of Environmental Earth and Science, Hokkaido University

The international Antarctic Institute (IAI) is an international, multi-campus program of education in cryosphere science. The institute was firstly proposed by the University of Tasmania and now 16 universities and institutions from 11 countries are involved as international partners. IAI aims to offer international standard education programs at undergraduate and graduate level with a special emphasis on Antarctic and cryosphere sciences. The universities and institutions share their curriculums within the framework of IAI partnership so that the students are able to take lectures and courses internationally. For those students who completed an agreed portion of the curriculum, bachelor and master degrees will be offered by IAI in addition to the degrees given by their home institutions.

Hokkaido University is enrolled in the IAI program as one of the leading universities in the field of cryosphere science. Institute of Low Temperature Science and Faculty of Environmental Earth Science have initiated a project to tailor and newly establish lectures and field courses for the purpose of IAI program. To offer a curriculum with an international standard, we collaborate internationally with Swiss Federal Institute of Technology (ETH) and University of Tasmania, and domestically with National Institute of Polar Research and Tokyo University of Marine Science. In May 2006, a glacier field course in Switzerland has been conducted for the first time with 15 students from Graduate School of Environmental Science. Another field course studying sea ice is planed in February 2007 at lake Saroma, East Hokkaido. Two lectures are commonly offered in Hokkaido University and in ETH by using a text book jointly published by professors in the universities, and also by e-learning systems. The curriculum is specially prepared with an English environment to accept students from all over the world.

P-4

Environmental role of methane Hydrate formation near sea bottom offshore Sakhalin, Okhotsk Sea

Hitoshi Shoji, Nobuo Takahashi, Hirotsugu Minami, Akihiro Hachikubo, Hirotoshi Sakagami, Alexey Krylov, Masato Kida
Kitami Institute of Technology

Fluid venting from depths of sea sediment will transport a significant amount of methane gas into sea water, and eventually to the atmosphere, contributing to enhance greenhouse gas activity for global warming. Gas hydrate formation near sea bottom may act as negative factor for the global warming by fixing methane gas in a solid crystalline form as gas hydrates. However, the details of this gas seep and fixation processes near the bottom are not understood quite well at present.

Side-scan-sonar survey with high-resolution seismo-acoustic profiling was performed offshore Sakhalin, Okhotsk Sea by the members of CHAOS (hydro-Carbon Hydrate Accumulations in the Sea of Okhotsk) project by Japanese, Russian, German, Belgium and Korean scientists in 2003. The survey results revealed characteristic distributions of gas hydrate accumulations with unique images of gas seepage structures and vertical fluid channel at/near sea bottom. More than 40 seepage structures were found within a 10 x 20 km survey area. The maximum size of seepage structure observed is about 600 m in diameter. Methane gas released from the seepage structures into the above water was detected as flare images by hydroacoustic profiling. Investigations for an understanding of methane hydrate formation mechanisms and monitoring of hydrate formation activities are required to understand the role of near-bottom hydrate formation for methane gas budget in the atmosphere and to discuss about future actions against long-term trend of increasing greenhouse gas contents.

P-5

Sustainable Farming System and Natural Resource Utilization: Evidence from the Rice-prawn Gher Fariming System of Bangladesh

Basanta Kumar Barmon, Takumi Kondo, Fumio Osanami
Laboratory of Development Economics Department of Agricultural Economics, Graduate School of Agriculture, Hokkaido University

This present study attempts to examine the economic evaluation and sustainability of rice-prawn gher farming system using indigenous natural resource use in Bangladesh. Experimental data and field survey data were used in the present study. Soils were collected after prawn production (before paddy production) and after paddy production (before prawn production) and tested in the Soil Resource Development Institute (SRDI) laboratory in Khulna, Bangladesh. The findings of the study indicated that the farmers used less chemical fertilizers in MV paddy production under the rice-prawn gher farming system compared to MV paddy production in Bangladesh and were statistically significant between the two agricultural systems. The main reason is that farmers apply various combinations of feed to gher plots during the prawn production and the leftover feeds make the land fertile for MV paddy production. Moreover, various types of algae and weeds grow on the bottom of the canal as well as the mid field of the gher farm, helping to make the land fertile for MV paddy production after prawn production. The cost of chemical fertilizers for MV paddy farming was about six times higher than MV paddy production under the rice-prawn gher farming system. However, per acre MV paddy production of MV paddy farming was almost same to MV paddy production under the rice-prawn gher farming system. The rice-prawn gher farming is a cost-saving technology for MV paddy production.

P-6

Problems in controlling invasive alien raccoons in Hokkaido, Japan

Tohru Ikeda, Go Abe, Yuji Masuyama, Shiro Tatsuzawa
Research Group of Regional Science, Division of Human Sciences, Graduate School of Letters, Hokkaido University

Irresponsible release and escape of pet raccoons (Procyon lotor) has caused their naturalization in Hokkaido, Japan. Raccoons had naturalized in cattle breeding area at first, where they could find food easily, then spread throughout Hokkaido.

Raccoons have opportunistic and omnivorous feeding habits, taking crops and fruit in agricultural areas and predating indigenous species such as the Japanese crayfish (Cambaroides japonicus) and the Ezo salamander (Hynobius retardatus) in

forests.
Nuisance control harvests of invasive alien raccoons were conducted in some areas in Hokkaido, but raccoons show high reproductive power and potentially rapid rate of population growth, thus it will be impossible to control invasive raccoons only by nuisance control harvesting. Intensive extermination under scientific control programs on the basis of adaptive management is indispensable to controlling invasive alien raccoons. As public awareness of invasive alien raccoon issues is low, except in some areas where agricultural damage is serious, educational efforts will be needed regarding invasive alien raccoon issues, especially irreversible impacts on native ecosystems.

P-7

Toward Sustainble Managemant in Japanese National Parks: Recreational impacts on natural resources and visitor experiences

Tetsuya Aikoh [1], Yasushi Shoji [1], Kazushige Yamaki [2], Kazuo Yamaguchi [3], Akihiro Kobayashi [4]
1/Hokkaido University, 2/Tohoku Research Center, Foresty and Forest Products Research Institute, 3/Consultant for Natural Resources Developments Inc., 4/Senshu University, Hokkaido College

Increasing number of visitors on outdoor recreational areas are threatening inherent conditions of such areas like national parks, national forest and world heritage registered sites in Japan. Soils are eroded, and alpine flowers are trampled by hikers on trails. Human waste and papers are found around shelters and campgrounds. Water contamination and disturbance of wildlife habitats are concerned. Also, quality of visitor experience are degraded. There are some conflicts among different type of visitors, such as hikers and bikers, kayakers and anglers, etc. Expected quiet atmosphere are loosing, because visitors are gathered at some summits, trailheads and accommodations, especially in some famous park like Mt. Fuji or Shiretoko.
To achieve sustainable management in natural recreational areas, some planning and management frameworks has been developing in North America, Recreational Opportunity Spectrum, Carrying Capacity, Limit of Acceptable Change, Visitor Experience and Resource Protection, etc. Those frameworks need to establish the management objectives which show the purposes and visions of such area, and the evaluation and monitoring of natural resource conditions and visitor experiences. On the other hand, Japanese National Park system seems to lack such type of planning and management framework. Lacks of reasonable planning and management framework is one of causes that park management are not effective. This series of posters describe the necessary of planning framework, the method to get exact recreational use statistics, and the importance of information about visitor choice behavior, toward sustainable management in Japanese National Parks.

P-8

Understanding Visitor Flows in Daisetsuzan National Park: Toward Sustainbale Management in Japanese Nationial Parks

Yasushi Shoji [1], Kazuo Yamaguchi [2], Kazushige Yamaki [3], Tetsuya Aikoh [1]
1/Hokkaido University, 2/Consultant for Natural Resources Developments Inc., 3/Tohoku Research Center, Foresty and Forest Products Research Institute

Visitor monitoring is fundamental to the sustainable management of recreation areas. Without this information, landowners or recreation managers cannot develop appropriate action plans to maintain natural resources and to manage quality of visitor experiences. In North American and European countries many studies have been conducted and a great deal of knowledge and techniques has been accumulated. In contrast to these countries, little attention has been given to the understanding of visitor monitoring in Japan.
Simple aggregation of self-registration books has been the main source of visitor counting in Japan. Most of mountain recreation areas, landowners or recreation managers request trekkers to write their information on self-registration books at trailheads, and it is said that not a few trekkers are willing to cooperate with it. Therefore, the official number of trekkers, which is reported by the Ministry of Environment, has also largely depended on simple aggregation of these self-registration data.
However, the number is fundamentally underestimation since there always exists some uncooperative trekkers, in addition a trend toward reluctance to cooperate with it against leaking of personal information has affected the registration rates. Thus, these ungraspable trekkers have evolved into an uncertainty on management of mountain recreation areas in Japan. Toward sustainable management, this paper examines closer annual visitor flows in the Omote-Daisetsu area, Daisetsuzan National Park, Japan, combining data from self-registration books and infrared trail traffic counters.

P-9

Understanding Hiker's choice behavior in Daisetsuzan National Park: Toward Sustainble Managemant in Japanese National Parks

Tetsuya Aikoh [1], Akihiro Kobayashi [2], Yasushi Shoji [1]
1/Hokkaido University, 2/Senshu University, Hokkaido College

The information about visitors' choice of the sites for hiking is useful to manage trails in recreational areas. Based on such information, managers will be able to take effective management actions to achieve the sustainability of the park. Visitors' choice behavior are known as the composition of several attributes such as personal factors, information sources and site attributes, etc. Increasing number of visitors and the change of access has caused the concentration of visitors on some popular routes, therefore natural resource impacts and the change of wilderness experience has been reported in Daisetsuzan National Park. Managers and stakeholders are seeking some management strategy to modify such situation.

Hikers were asked to rate the importance of 21 attributes about the routes, the trailheads and the camp sites. We also asked the information sources, the motivation, their experience and their willingness to next visit. The result of factor analysis showed that visitors considered the convenience of camp site, the walkability of route, the convenience of trailhead, the condition of natural resource and the less visitors. Those factors had relationships with their motivation, information sources and their experience of hiking and Daisetsuzan National Park. We found the significant relationships among visitors' personalities and site attributes which they had considered. Those information will be helpful for managers to control visitor flows and to choose the information they offer.

P-10

The industrialization of agricultural villages and the employment structure in the Sunan area of China - A follow-up research of Kaixiangong village -

Hong Park
Graduate School of Agriculture, Hokkaido University

In China, reform of the ownership system of enterprises was promoted on a large scale in the late 1990's. Due to the increase of private enterprises, "Sunan model", which was owned by the town and village enterprises, has become a "Wenzhou model". This paper clarifies the real state and characteristics of farming village industrialization, centering on one of the villages in the Sunan area. In addition, by making clear the present status of progress of home-based industry, this presentation ascertains the change in the agricultural work structure in the economic development area, based on the existing study materials and actual condition survey.

P-11

Analysis of Indemnity for Community related to the World Natural Heritage Site — on Fisheries Management in Shiretoko —

Yayoi Hisasue
Graduate School of Law, Hokkaido University

On July 14, 2005, Shiretoko was finally registered as the World Natural Heritage Site.
Now, dynamic ecosystem of Shiretoko which contains both the land and sea become well known to the world.
On the other hand, Shiretoko shows through Japanese fisheries management that it is a difficult and delicate problem to balance up interests of communities in the Site.
This research tries to find the best way to indemnify for communities which suffer losses from ecosystem conservation policies which implemented in the World Natural Heritage Site.
The history of Japanese fishing rights began with the Fisheries Law of 1902(Meiji era) which licensed fishing rights for the first time. Since postwar amendment of 1949(Showa era) adopted a concept of "adjustments for fishing", Japanese fishing

rights have had natures both property right as legal and environmental right as essential. Shiretoko fisheries management raises the question of where shall we find the common ground when the nature of environmental right restricts the exercise of fishing rights.
In the context of a new conflict between fishing rights and environmental right, change in the substance of "environmental right" might exist which is influenced by the stream of International Environmental Law that regards ecosystem conservation as most important.
It is necessary to establish strict fishery resources management system developed from old concept of adjustment for fishing to reach both goals of "marine ecosystem conservation" and "sustainable development in the sea" that is to say on one hand to meet the IUCN(International Union for Conservation of Nature and Natural Resources) demand to regard ecosystem conservation as most important among diverse values which the World Heritage Convention(1972) brings and on the other to continue Shiretoko fishing based on fishing rights. Thereby it is appropriates to outline the way to indemnify for communities in Shiretoko World Natural Heritage Site in three phases as follows:
I establish strict fishery resources management system,
II adopt administrative fisheries controls as a part of above system,
III and allow those whose fisheries rights are injured bringing actions(administrative/ civil) for their damages.
Actually, Shiretoko fisheries management raises our environmental awareness which shift from the amenity improvement stage to the Global Environment Facility stage.

P-12

Why could be small villages inside of dolines in China sustained for centuries?

Tadao Ando [1], Eriko Okada [1], Katsuhiko Demura [2], Toshiaki Tadano [3]
1/Hiroshima University, 2/Hokkaido University,
3/Tokyo University of Agriculture

Among the thousands dolines distributed in the limestone area in Western China, around one thousand of dolines have been inhabited for the past several hundreds years. The very steep limestone walls surrounding the village limited the villagers' activities to exchange materials with the outside of the dolines. There is no river above ground in the villages. Therefore, the villagers have been mostly dependent on the products inside of the dolines including basic life-supporting materials like water and foodstuff.
In order to elucidate the reasons why these life-supporting systems were sustainable for several centuries, we tried to analyze the material-cycling systems in the village in collaboration with the local scientists in China. The followings are the main findings obtained;
1) The solar energy was almost sole source of the energy to support the villagers' lives and activities. They obtained the essential energy from the food (mainly corn, beans and vegetables with occasional intake of meat) and the wood (for fuel and timbering) produced inside of the dolines.
2) Two types of mineral nutrient cycling routes were recognized in the system; the closed cycling route passing mainly fields and rather open cycling route passing through forest. The both route joined in the human life and the nutrients were incorporated in the fields as ash minerals.
3) Since almost all the materials including human bodies were incorporated in the recycling systems, there were not found any waste materials.
4) The people were very diligent and healthy, and passing constant daily life.
Though the way of living is not applicable to the industrialized countries, the fundamentals underlying those findings may be helpful for us to develop a sustainable society.

P-13

Wildflowers in Hokkaido as a natural resources - their conservation, creation, sustainable management, and use-

Tetsuya Kondo, Hajime Matsushima
Research Faculty of Agriculture, Division of Bioresources and Product Science

Although most parts of the mainland Japan have been developed, some areas in Hokkaido with several natural resources still remain. In particular, habitats of wildflower species with beautiful flowers are characteristic and important natural

features in Hokkaido. Some of these habitats have been conserved, and are used as sightseeing destinations or for recreation purposes, already.
In this study, personal interview surveys and field investigations were conducted at nine sites at which are wildflower habitats to determine the site characteristics, vegetation type, maintenance methods used, and utilization patterns.
Five sites were public domain land, two sites were on company-owned land, one site was in the precincts of a Shinto shrine, and one site was on the campus of a university. Most of the plant species that were conserved were spring ephemerals that are peculiar to the Northern region in Japan. Eight sites were managing pre-existing habitats, and one site was managing a habitat created by transplantation of individuals. All the sites were managed by mowing understory once or twice a year during summer or autumn. The duration of mowing ranged from 5-45 years. The site of each habitat of wildflower was used as a sightseeing location, for a stroll, or for nature observations.
We assume that, in Hokkaido, there are many promising wildflower habitats that are being suppressed by competitive species such as Sasa senanensis. We will be able to establish aesthetic wildflower habitats by suitable management of them, and also create new aesthetic wildflower habitats by transplantation of wildflower individuals. Aesthetic wildflower habitats that are maintained sustainably by appropriate maintenance strategies will be useful for a sightseeing location, for a stroll, or for nature observations.
The evaluation of such wildflower communities will be also necessary in the future.

P-14

Sustainable coastal management for recreational use and natural resource conservation: The case of Ishikari Coast, Hokkaido

Hajime Matsushima, Tetsuya Kondo
Graduate School of Agriculture, Hokkaido University

The purpose of this study is to consider and propose sustainable coastal area management method for their recreational use and natural resource conservation. Ishikari coast, 10km long at middle part of Hokkaido, was used by a lot of people for recreational use (e.g. swimming, barbeque, fishing, ATV, PWC) in summertime. Such a concentration of recreational use caused the impact of natural resources and the conflict between recreational users, especially motorized vehicle users and others. This poster resulted in the necessity of future vision and environmental education for sustainable coastal management, which Ishikari coast does not have established yet. Future vision means a framework of decision making for management planning. To establish the vision, application of natural park system were proposed.
Environmental education has great potential to enhance knowledge in the short run and to prompt attitude change in the long run. This research showed that the visitor landscape preferences were different according to their purpose. Such a "gap" may cause the conflict between visitors who have different purpose. This result showed that the effort to fill in the gap, called environmental education (share of the information, sign board, guides, etc.) is important. This poster was concluded that the application of natural park system is suitable to this area for the sustainable coastal management.

P-15

Design Viewed from the Perspective of Sustainalbe Development

Mirei Hagiwara, Nozomi Hokari, Kazuyuki Seino, Shun Niizuma, Masuyo Tokita
Hokkaido Universityy

Design is indispensable to achieve a society that promotes sustainable development. Products surrounding us affect our daily life physically, mentally, aesthetically, economically, and environmentally.
The way we design products reflects our approach to society. In other words, our daily actions and judgments in making and selecting products reflect our society's sense of values.
Therefore, we propose, as an extension of our freshman semiar course entitled "Power of Design", to reevaluate materials indigenous to Japan and re-examine traditional designs and techniques associated with these materials.
Among the various natural materials that will help us return to a "cradle to cradle" society, we will focus on bamboo and diatomaceous earth. We will first analyze their properties and current uses, and then present functional and beautiful designs suitable for these materials. Through the use of daily products made of such natural materials, we will learn to appreciate the beauty that nature bestows on us.

Such happy experiences will raise individual awareness of ecology and encourage responsible social behavior that does not overload our environment.

P-16

Effect and effectiveness of vaccination: pertussis in NZ as the case of sudy

Andrei Korobeinikov
RIES, Hokkaido University

In some cases vaccination is unreliable. For example vaccination against pertussis has comparatively high level of primary and secondary failures.
To evaluate efficiency of vaccination we introduce the idea of effective vaccination rate and suggest an approach to estimate it. We consider pertussis in New Zealand as a case study. The results indicate that the level of immunity failure for pertussis is considerably higher than was anticipated.

P-17

Research and Development of ubiquitous information services for sustainable fisheries operation and management in the offshore around Japan

Sei-ichi Saitoh [1,2], Fumihiro Takahashi [2], Daichi Tachikawa [2,3], Motoki Hiraki [2,4], Masami Yoshida [2,5], Teruaki Hiura [2,5], Hidetada Kiyofuji [6]
1/Laboratory of Marine Bioresource and Environment Sensing, Graduate School of Fisheries Sciences, Hokkaido University, 2/SpaceFish LLP, 3/Fujitsu Hokkaido Systems Limited, 4/GIS Hokkaido Limited, 5/Fujitsu Limited, 6/Joint Institute of Marine and Atmospheric Research University of Hawaii

This paper presents an overview of a newly developed ubiquitous fisheries information system using satellite remote sensing and geographical information system (RS/GIS). The system was developed to aim for providing high value-added fisheries oceanographic information in anytime and at anywhere. We also make this system to come into wide use for especially fishermen and managers in fisheries cooperation or fisheries experimental stations. All users can operate all products dynamically such as overlaying, measuring distance from nearest port or fishing grounds on the GIS. This system can help to support effective fishing activities such as economy with time for fishing ground destination or nearest landing port. This ubiquitous information services promise to promote sustainable fisheries operation and management in the offshore around Japan.

P-18

Organochlorine Pesticide Residues in the Pasture Environment, Meat and Milk of Philippine Buffaloes (Bubalus bubalis) from Angat, Bulacan

Elenanor S. Austria [1], Dr. Evangeline C. Santiago [2]
1/Faculty, Natural Science Department, Adamson University, Manila, Philippines
2/Head, Research and Anayltical Services Laboratory, Natural Science Research Institute, University of the Philipines, Diliman

The levels of OCP residues in environmental samples (soil, sediments, water and forage) as well as in meat and milk of Philippine Buffaloes from Angat and CLSU were determined. From Angat, Barangays Laog and Banaban were chosen because of its history of pesticide use and a preliminary study revealed the presence of several OCP residues. CLSU-PCC was chosen as the pseudocontrol area because although pesticide use was stopped more than a decade ago, contamination of the area cannot be ruled out.
Samples were collected from August 2002 to October 2003 and were taken to the Research and Analytical Services Laboratory of the Natural Science Research Institute (RASL-NSRI), University of the Philippines, for analysis. In the laboratory, soil, sediments and meat samples were extracted with DCM and hexane by Soxhlet apparatus for 8-16 hours. The extract was cleaned up using column packed with fully activated silica. Forage samples (grasses, legumes and feed concentrate) were extracted with acetone by sonication and cleaned up with silica and alumina. Milk samples were extracted with hexane and ethyl alcohol by sonication with reflux. Each sample was spiked with a surrogate standard (teterachloro-m-

xylene), OCP mix and internal standard mix (pyrene-d-10, phenanthrene-d-10) to assess performance of the method. A recovery of 60- 120% was considered acceptable. Method Detection Limits (MDL) was also determined for each compound and was computed based on US EPA method. Levels below MDL were reported as <MDL.

Analysis of water samples revealed residue levels below MDL indicating low levels of contamination. However almost all of the studied OCPs were detected in soil samples from Banaban and Laog with Banaban having the highest amount of contamination, 39.89 μg/kg. It is followed by Laog (37.97 μg/kg) and CLSU (6.48 μg/kg). It is possible that the longer use of OCP in Laog and Banaban than in CLSU resulted to higher level of contamination in soil from these areas.

The contaminants detected in soil samples were also the same contaminants detected in sediment samples. Laog contains the highest amount of contamination (104.20 μg/kg) followed by Banaban and CLSU (51.54 μg/kg and 1.72 μ g/kg, respectively). The higher amount of contamination in Laog sediments may be due to the more intensive use of irrigation in Laog than in Banaban and CLSU.

Analysis of OCP residues in forage samples revealed that endrin ketone was the predominant contaminant being present in all forage samples in high amounts. CLSU feed concentrate was also found to contain higher residue levels than grasses and legumes taken from the three areas. In meat, almost all of the studied OCP were present with the cyclodienes, heptachlor, dieldrin and endrin aldehyde as the predominant contaminants. But although many residues are found in the environment and meat of carabaos, only a few residues were present in milk samples. This may be because body burdens were not high enough to be incorporated in the milk. Comparison with the Codex EMRLs for meat and milk revealed that all of the detected residues were below their respective EMRLs suggesting that it is relatively safe to consume these animal products.

P-19

Determination of the presence of Organochlorine Pesticide Residues in the Einvironment of IPO Dam

Elenanor S. Austria

Faculty, Natural Science Department, Adamson University, Manila

The levels of OCP residues in environmental samples (soil, sediments, water) from Ipo Dam were determined. Samples were collected in September, 2005 and taken to the Research and Analytical Services Laboratory of the University of the Philippines, Diliman. Analysis of the water samples revealed that the levels of all of the studied OCP residues were below the Method Detection Limits (MDL), suggesting very low levels of contamination. In sediments, only residues of endrin aldehyde and endosulfan 2 were detected in Ipo Dam and comparison with the data from Laog , an agricultural community revealed Ipo Dam contained less OCP residues. This study also found out that the levels of OCP residues in sediments were higher in Laog, than in Ipo Dam (total OCP mean concentration: 6.0 ug/kg in Ipo Dam and 67.71 ug/kg in Laog). This may be due to the more intensive use of chemicals and irrigation in Laog. The analyzed soil samples revealed that only residues of endosulfan sulfate was present in soil samples from Ipo Dam. Comparison of the total OCP mean concentration in soil revealed that Laog has a higher amount of contamination than Ipo Dam (16.15 ug/kg in Ipo Dam and 4.24 ug/kg in Laog). Since pesticide use was not allowed in the watershed area, the presence of endosulfan sulfate residues may mean that Ipo Dam has received inputs of the persistent OCP residues from the surrounding agricultural areas.

P-20

21st Century Center of Excellence Program 'Prediction and avoidance of an abrupt change in bio-geoshpere system'

Motoyoshi Ikeda

Faculty of Environmental Earth Science, Hokkaido University

"Global warming by CO2", "ozone depletion", "forest destruction by exploitation" and "pollutants" are not influencing the environment independently. A possible feedback loop is that "Low absorption of CO2 caused by forest destruction" promotes "global warming", and then, "global warming" in turn enhances "forest destruction". They interact each other. Therefore, we need to understand these phenomena as a coupled system and to predict a future change. We are trying to understand and predict the phenomena by clarifying on the basis of bio-geoscience and intercomparison between the high latitude region and the low-to-mid latitude region. Our final objective is to avoid the abrupt change by not controlling nature but helping it from the cycle between natural ecosystem and material circulation.

P-21

The Land Use Changes and Modern Landscape Structure of the Russian-Chinese Transboundary Geosystem

Natalia Mishina
Research Institute of Humanity and Nature (RIHN)

Anthropogenic impacts on the adjacent territories of North-eastern China and the Russian Far East are considerably different. But a number of such territories have similar natural conditions and are the parts of integrated formations - transboundary natural geosystems. Both ecological and economical conditions of every transboundary territories depend on one another. Therefore transboundary territory's researches have large theoretical and practical value for the planning their sustainable development.

The territory of our research is the transboundary low mountain region with common geologic and geomorphologic structure, similar soils, vegetation and climate. The Ussuri River, on which the state boundary of Russia and China passes, divides this territory into two almost equal parts. The Chinese part of the transboundary geosystem is situated in Heilongjiang province, the Russian one is in Primorskii and Khabarovskii krais.

To conduct the ecologic-geographical analysis of the transboundary geosystem, the map of its modern landscapes was compiled, the main features of landscape structure were determined. Statistical economic data and tendencies of resource's use were also analyzed. It allowed us to define the main stages of economic and land use development of Russian and Chinese part of geosystem. Studying of land use changes from 1990 to 2000 showed the major trends of modern landscape transformation and the basic ecological problems in the different parts of the transboundary geosystem. Some measures on improvement of their ecological situation were offered. The obtained data were mapped.

In conditions of deficiency of the unified information about the Russian-Chinese geosystems, the received information is the important basis for further planning of the sustainable territorial development of the near-boundary administrative formations of both countries.

P-22

Germination and growth responses of some key plant species from Horqin sandy land of China to the simulated desertificated conditions

Lijun Chen
Institute of Applied Ecology, Chinese Academy of Sciences

There is little knowledge on the germination and growth response of key plant species in Horqin sandy land, to environmental stress conditions. This study aim to investigate the effects of different temperatures and light intensities on the germination of 7 key plant species, and the influence of interaction of varied nitrogen/phosphorus regimes simulated different degrees of degraded soil on the growth of 4 key plant species grown in desertificated area in Horqin sandy land.

P-23

Decentralized Cooperation for Sustainable Development: Toward Paradigm Shift for International Cooperation Framework

Kuniko Seki
Graduate School of International Media and Communication, Hokkaio University

For many years, nation states have made significant efforts to resolve diversified and complicated global issues in cooperation with international organizations, NGOs and private companies. Despite these experiences, accumulated under existing international cooperation framework, global issues remain unsettled.

Then, what is an effective international cooperation framework to cope with global issues? One alternative framework, decentralized cooperation (cooperation decentralisee), sets out to give us an answer to this question.

Decentralized cooperation is a form of grass-roots international cooperation, institutionalized by French government in 1992, between French municipalities and their counterparts in developing countries. Under this framework, French municipalities offer techniques, knowledge and know-how to their partner cities in almost every field concerning public administration (environment, education, public health, urban and rural development, etc.).

Why have existing international cooperation frameworks failed? One of the main reasons has been insufficient effort aimed at strengthening the basis of democratic public administration systems in developing countries. In other words, without

reinforcing self-resolving capacity against local problems, sustainable development of recipient communities can not be assured. In this meaning, decentralized cooperation seems useful for recipient communities, assuring transfer of public administration experience from French municipalities to their external counterparts.
Furthermore, we can remark other advantages of decentralized cooperation, compared with classical international cooperation frameworks: First of all, we can observe a less hierarchical relationship between supplier and recipient of decentralized cooperation. Because, in general, decentralized cooperation is concerned with the benefits of the vast existing sister city network established between French and foreign municipalities, respecting the reciprocal and equal partnership. Secondly, sister city relationships assure also long-term cooperation, one important element for sustainable development. Thirdly, long-term and equal partnership enables French municipalities to reply precisely to local needs, which is often needed by recipient municipalities.
Therefore, decentralized cooperation should be considered as a new paradigm for the international cooperation framework.

P-24

Life Cycle Assessment of Fishery Products - Case studies of Squid and Scallop production -

Kazuhito Watanabe [1], Teisuke Miura [2]

1/Miyagi Prefectual Government, 2/Graduate school of fisheries science, Hokkaido university

It is indispensable to incorporate environmental measures into fishery production process in addition to a resource and economic viewpoint to achieve sustainable fishery. Life Cycle Assessment (LCA) is an important and useful tool to evaluate the environmental effects and potential impacts associated with a product and a service throughout its life span. Up to date, however, few data have been reported concerning the environmental burden of fisheries. In this research, we quantitatively calculated the environmental burden of the entire squid and scallop fishing systems in Hokkaido and assessed the environmental impacts using LCA. Squid and scallop were chosen for this case study because they are important fishery products for the Japanese food supply. Moreover, we suggested the evaluation procedure, while applying LCA to the fishery. As to squid related fishery, squid jigging fishery exhibited the largest environmentally burden, followed by off-shore trawl fishery, and large scale set-net fishery. The results suggested the largest value of the squid jigging fishery was mainly due to the use of fuel oil by fish gathering lamps. As to the scallop cultivation industry, on the other hand, the value indicated the ground sowing method was superior to the hanging method. We demonstrated that LCA was applicable to fishery, and this new methodology was to be useful toward the improvement of the environmental aspects of fishery.

P-25

Rabies in Sri Lanka: Knowledge, attitudes, practices and beliefs among community-dwellers

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]

1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]
Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces.
Objective
To assess the knowledge, attitudes, practices and beliefs of the study population about rabies.
[Materials and Methods]
This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample

consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.

[Findings]

Most respondents knew that dogs are the most common reservoirs in Sri Lanka (90%) and that rabies is a fatal disease (79%). Eighty-eight percent knew that rabies could be prevented by regular animal vaccination while nearly half knew the universal pet registration law (55%). Majority preferred to seek treatment from physicians if bitten (95%) while the most common reason for not consulting was the distant location of health practitioners (49%). Although most pet dogs were vaccinated (76%), only 44% of immunization cards were shown during the interview. Ninety-three percent would send their pets for free immunization, however, 46% would send them immediately and 40% would send upon respondents' time availability. Although only 43% were aware that the head of the suspected animal should be sent to diagnostic laboratories for confirmation, 58% were willing to send the specimen. While 85% favored animal population control, common reasons against it were personal beliefs (44%) and religion (38%). Most pet dogs were fed more than 3 times per day (85%) and were free-roaming (33%).

[Discussion and Conclusion]

Public health education, awareness and advocacy are vital for disease eradication. Intensified animal welfare programs and responsible pet ownership, especially in inaccessible areas, would be most valuable to increase community participation.

P-26

Rabies in Sri Lanka: Assessing health-seeking behavior following animal bite injuries

Matibag GC [1], Kamigaki T [1], Kumarasiri PVR [2], Wijewardana TG [3], Kalupahana AW [3], Dissanayake DRA [3], De Silva DDN [3], Gunawardena GSP DeS [3], Obayashi Y [1], Taniguchi T [4], Sawa H [5], Umemura T [6], Tamashiro H [1]

1/Department of Global health and Epidemiology Division of Preventive Medicine, Graduate School of Medicine, Japan,
2/Faculty of Medicine, University of Peradeniya, Sri Lanka,
3/Faculty of Veterinary Medicine and Animal Science University of Peradeniya, Sri Lanka,
4/Ministry of Healthcare, Nutrition and Welfare, Sri Lanka Japan International Cooperation Agency,
5/Department of Molecular Pathobiology and 21st Century COE Program for Zoonosis Control Hokkaido University Research Center for Zoonosis Control, Sapporo, Japan
6/Department of Vetarinary Clinical Sciences, Graduate School of Veterinary Medicine, Hokkaido University, Japan

[Background]

Although Sri Lanka had adopted its national program for the elimination of rabies during the mid-1970s, this fatal disease still remains endemic in all provinces with an annual dog bite incidence of 2,000/100,000 and human deaths at 4/100,000. Data on health-seeking behavior after animal bites have not been properly studied at the community level.

Objective

To establish the benchmark data on medical care-seeking behavior and treatment compliance among animal bite victims in selected localities of the Central Province, Sri Lanka.

[Materials and Methods]

This cross-sectional study, performed on 8-25 May 2006, utilized in-person interviews using structured and pre-tested questionnaires in the urban, rural and estate sectors of Kandy District, Central Province. After randomized selection, the sample consisted of 6,925 persons from 1,570 households of the 26 survey areas, which represented 0.5% of the population of Kandy District.

[Findings]

A total of 357 animal bite cases (5,155/100,000) and 2 cases of rabies deaths (29/100,000) have been encountered 12 months prior to the survey. One was a documented case while the other died at home. Eighty-eight percent of injuries fell within 6 to 64 years of age (mean: 33.84 years; 95% CI: 31.73-35.95). Bites in males (54%) were more than in females (46%). Bites on the legs and feet were the most common (60%). Dogs were the most frequently attacking animals (93%) and were mostly pets (75%) that were previously vaccinated (53%). Half the cases occurred at home. Most patients have consulted physicians for treatment (96%). Most patients (86%) received post-exposure vaccine less than five times upon physicians' advice (50%) and upon observation that the animal remained healthy and with prior immunization history (9%).

[Discussion and Conclusion]

Our results showed that the incidence of annual animal bites and human rabies are well above the reported national average. It is of paramount importance to carefully examine the existing surveillance and reporting systems. We highlight the

importance of universal registration and immunization coverage especially for owned pets to prevent potential rabies transmission.

P-27

Environmental Impact on Wildlife

Mayumi Ishizuka, Kentaro Sakamoto, Shoichi Fujita
Graduate School of Veterinary Medicine, Hokkaido University

Chlorinated / brominated persistent toxic substances (PTS), such as polychlorinated, -dibenzo-p-dioxins, -dibenzofurans, -biphenyls, -organochlorine pesticides, hexachlorobenzene, 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane (DDTs), hexachlorocyclohexane and -brominated diphenyl ethers, are ubiquitous contaminants in the environment. Due to the high lipophilicity / resistance to biological degradation, wildlife animals and humans accumulate notable levels of them through food chain. Our research subject is to elucidate the biological effects of these environmental pollutants on wildlife, such as crabs, fishes, birds and mammalians.
Especially, we detected the high level of PTS accumulation in top predators, e.g., seals, Steller's Sea Eagle and White-tailed Sea Eagle. The residues of PTS caused the suppression of thyroid hormone and induced xenobiotic metabolizing enzyme, which was biomarker enzyme for the contamination of planar compounds.
In the meantime, until to day, there is few document reported contamination of PTS in terricolous wild animals. Norway or Brown rats (Rattus norvegicus) inhabit over world especially close to human population. The Brown rats are useful indicator for the effects of environmental contamination on land-wildlife due to their position in food-chain. In recent study, we found the high concentration of PTS in liver of wild Brown rats, and the contaminants affected the gene expression profiles in testis and liver.
We concluded that our environment is polluted enough to find animals with altered hormone levels.

P-28

Sustainability cannot be realized without the Environmental Governance and the Participation of Indigenous Peoples

Yugo Ono
Graduate School of Environmental Science, Hokkaido University

Sustainability is a concept which postulates the environmental safety over the generations. If the environment is destroyed for the convenience of the present life, it is not sustainable. This corresponds to the idea of the Native American's saying that the Earth is not the heritage from the Ancestor, but we rent it from the future generation. Although the sustainability is a global concept, we have to act locally to realize it. Here I will take two cases in which we are acting in Hokkaido as environmental scientists to realize the sustainability of our planet.
1: Conservation of natural river ecosystem
The natural river is rare even in Hokkaido where the dam construction and all kinds of concrete works have destroyed the natural river ecosystem especially the migration of salmonids through the 20th century. Hokkaido Development Agency has planned the construction of a big dam (46m high, 300m wide) in the Sanru, a tributary of the Teshio, the second longest river in Hokkaido. The dam not only cuts the migration but breaks the spawning habitat of cherry salmon which is important fishing resources. Major purposes of dam construction are flood control, power generation and water supply. But they are satisfied by alternative ways which do not destroy the environments. Free and open discussion is needed to evaluate the alternatives, but it is not realized by the policy of Hokkaido Development Agency. Change of the decision making system is necessary for such environmental issues. Environmental governance is urgently introduced.
2: Participation of Indigenous Peoples
Sustainability cannot be realized in a society where the equality is not certified. The Ainu, the indigenous people in Japan, is still in the position not equal to the other Japanese people. They lost the rights of caching salmon, shooting brown bears and deer, and land rights. Public education of their language has never been done for a long time. Their land names of the Ainu language have been changed to the Japanese. Recovery of the Ainu's rights and culture should not be neglected when we talk of sustainability.

P-29

Amur-Okhotsk Project 2005-2009

Takayuki Shiraiwa
Research Institute for Humanity and Nature

Recent studies in the northern North Pacific have revealed that biological productivity was limited by iron availability there. Because iron can be hardly dissolved in water, phytoplankton largely relies on the iron supply from land via the atmosphere and/or rivers. In contrast to the central region of the northern North Pacific, the phytoplankton productivity is very high in the Sea of Okhotsk, probably due to the sufficient supply of iron from the Amur River. Riverine iron cannot keep dissolved in the seawater without being a complex with humic substances created in forest and wetland. Therefore, changes in land uses on the Amur basin such as deforestation, forest fire, cultivation, urbanization and/or reduction of wetland may reduce the biological productivity in the Sea of Okhotsk and the northwestern area of North Pacific Ocean.

In this project, we try to answer the following questions; 1) how large is the discharged flux of materials such as iron from the Amur River, how far the iron is transported offshore and to what extent the iron is contributing to the biological productivity in the Sea of Okhotsk; 2) what are the factors controlling the release of materials such as iron from the land to the Amur River in the natural and/or artificially altered land surface conditions in the Amur basin; 3) to what extent the economic and political systems around Northeast China and Far East Russia change the land uses in the Amur basin in the past, present and future; 4) how variable are the water and material cycles around the Amur basin and the Sea of Okhotsk in the natural conditions.

P-30

A Lower Trophic Ecosystem Model Including Iron Effect in the Okhotsk Sea

Takeshi Okunishi
Graduate School of Engineering, Hokkaido University

The Okhotsk Sea is one of the most biologically productive regions in the world, and it supports high fisheries production. The micronutrient iron plays a key role in limiting phytoplankton growth rates and structuring plankton communities over much of the world ocean. Recent studies have shown that iron is an important factor controlling phytoplankton in the western subarctic Pacific Nitrate is depleted after the spring phytoplankton bloom in the Okhotsk Sea. This fact suggests that iron supply is higher in the Okhotsk Sea than in the western subarctic Pacific and, that phytoplankton growth is not limited by iron availability in the Okhotsk Sea. However, it is not well known whether iron limits phytoplankton growth or not, or what is the main source of iron in the Okhotsk Sea. We applied a three dimensional ecosystem - physical coupled model including iron effect to the Okhotsk Sea. In order to clarify the sources of iron, four iron compartments were added to Kawamiya et al. (1995)'s model (KKYS) to create our ecosystem model (KKYS-Fe). We hypothesized that four processes supply iron to sea water: atmospheric loadings from Northeastern Asia, input from the Amur River, dissolution from sediments and regeneration by zooplankton and bacteria. We simulated 1year, from 1 January, 2001 to 31 December, 2001, using both KKYS-Fe and KKYS. KKYS could not reproduce the surface nitrate distribution after the spring bloom, whereas KKYS-Fe agreed well with observations in the western subarctic Pacific because it includes iron limitation of phytoplankton growth During spring bloom, the main source of iron at the sea surface is from the atmosphere. The contribution of riverine iron to total iron utilized for primary production is small in the Okhotsk Sea. Atmospheric deposition, iron flux from sediment and regeneration of iron in water column play an important role in maintenance of high primary production in the Okhotsk Sea.

Keywords: ecosystem model, Okhotsk Sea, phytoplankton, iron, primary production

P-31

Evaluation of the impact of water dilution within the eutrophic Lake Barato, Japan

Ryuichiro Shinohara
Graduate School of Engineering, Hokkaido University

Lake Barato is a eutrophic and subarctic 4.37 km2 lake in Hokkaido, Japan. This lake is an oxbow lake that was isolated from the Ishikari River following the development of flood-protection measures on the river. Although environmental criteria for water quality in Japan are defined as total nitrogen (TN) less than 71 ?mol L-1 and total phosphate (TP) less than 3.2 ?mol L-1, levels in Lake Barato exceed these standards by a factor of three (TN: 229 ?mol L-1; TP: 6.3 ?mol L-1). To dilute eutrophic water in Lake Barato, an Inlet Project was carried out during the summer of 2005 via a 1 m3 s-1 inlet from the Ishikari River. In this study, field data and three-dimensional numerical simulations are used to evaluate the impact of water dilution on eutrophication. River water was discharged from the margin of the upper section of the lake to dilute the water. We undertook a numerical simulation of total nitrogen (TN) and total phosphate (TP) distribution and its impact on the emergence of cyanobacteria considering five inlet cases. Model results suggest that the most effective and feasible way to achieve dilution is via a 5 m3 s-1 inlet and open the Shinko Gate, which connects the lake and Ishikari Bay through the channel. Following this scheme, TN and TP concentrations were reduced by 28% following 30 days of discharge according to the simulation results.

Keywords: Lake Barato, dilution of a eutrophic lake, numerical model

P-32

COMPARISION OF PERFORMANCE AND MEMBRANE FOULING CHARACTERISTICS BETWEEN PRESSURIZED AND SUBMERGED PVDF MICROFILTRATION MEMBRANES

So-Ryong Chae
Graduate School of Engineering, Hokkaido University

As a means of complying with current and anticipated regulations, membrane technologies have been widely adopted in the world. Especially, the low-pressure driven membrane techniques such as microfiltration (MF) and ultrafiltration (UF) have attracted a considerable amount of attention in drinking water treatment to remove particulate by size exclusion and usually produce a filtrate free of turbidity and bacteria from river, lake, and underground waters.

There are two different configurations (i.e. pressurized and submerged modules) of membrane filtration technology. Submerged module has become a major feature in wastewater application of membrane technology. Many researchers reported that this module remarkably reduced the power consumption of recirculation pumps used in a membrane bioreactor. However, there were no available reports comparing the pressurized and submerged membrane modules in water treatment. The goal of this study was to compare process performance and fouling characteristics between pressurized and submerged PVDF (polyvinylidene fluoride) hollow fiber membranes having 0.1? nominal pore size (MicrozaR, Asahikasei Chemical co., Japan) treating Chitose River water having relatively high turbidity and humic substances under the same operating conditions (permeate flux of 0.65 m/d, recovery rate of 92%, and physical cleaning using permeate and the compressed air for 90 s).

As a result, turbidity (100%), Al (> 84%), and Fe (> 95%) were removed very well by both membrane modules. However, humic substances and Mn were not effectively removed by the membranes. On the other hand, different fouling characteristics of the two membranes were observed during the experimental period.

In case of the submerged membrane, fouling could be effectively mitigated by backwashing and air scrubbing. In contrast, fouling of the pressurized membrane could not be easily recovered once it increased rapidly. Focused on this point, characteristics of foulants in both membranes were studied. As a result, it was found that relatively large amounts of organic matter (especially carbohydrates and humic substances) and Fe were extracted from the cake layer of the pressurized membrane than that of the submerged membrane.

In addition, from the surface analysis, it was observed that the cake layer formed on the pressurized membrane surface was intensely smoother and thicker than that formed on the submerged membrane surface. Finally, it was recognized that interaction between organic matters and Fe in the pressurized membrane improved significantly the cake compressibility and stability deteriorating membrane fouling.

Keywords: drinking water treatment, pressurized and submerged modules, PVDF, membrane fouling, surface analysis

P-33

Development of a super high-rate ANAMMOX reactor and in situ analysis of biofilm structure and function

Ikuo Tsushima
Graduate School of Engineering, Hokkaido University

The anaerobic ammonium oxidation (ANAMMOX) process is a new efficient and cost effective method of ammonium removal from wastewater. Under completely anoxic conditions ammonium is oxidized with nitrite as electron acceptor to dinitrogen gas and small amounts of nitrate. This process has many advantages as it demands no oxygen and no organic carbon source and produces small amount of sludge and could make the reactor footprint smaller than that of conventional systems. However, it is difficult to cultivate the ANAMMOX bacteria due to their low growth rate (the dabbling time is approximately 11 days). This indicates that rapid and certain start-up of ANAMMOX process is apparently the key to practical application. However, there is still little information on the efficient screening method of appropriate seeding sludges for ANAMMOX process. Therefore, in order to screen a good seeding sludge for the ANAMMOX process, we developed the real-time quantitative polymerase chain reaction (RTQ-PCR) assay with newly designed primers for the quantification of the ANAMMOX bacteria in the sludge. Thereafter, we successfully obtained a seeding sludge with high abundance of ANAMMOX bacteria and inoculated this sludge into an upflow anaerobic biofilter (UAB). The UAB was operated for more than one year, and the performance of ANAMMOX process was monitored. As a result, we successfully achieved the highest nitrogen removal rate of 26.0 kg-N/m3/day, which has never been reported. In addition, the ecophysiology of ANAMMOX bacteria (spatial distribution and in situ activity) in biofilms was analyzed by combined use of a full-cycle 16S rRNA approach and microelectrodes to be improved and stabilize the performance. As a result, the microelectrode measurement clearly revealed that a successive vertical zonation of the partial nitrification (NH_4^+ to NO_2^-), ANAMMOX reaction, and denitrification was developed in the biofilm in the UAB. This result agreed with the spatial distribution of corresponding bacterial populations in the biofilm. The coexistence of ammonium oxidation bacteria (AOB), ANAMMOX bacteria, and denitrifiers gives mutual advantages, such as that AOB and Eubacteria give the ANAMMOX bacteria an advantage by consuming dissolved oxygen and organic matter derived from ANAMMOX reaction. We will link micro-scale information (i.e., single cell and/or biofilm levels) with meso-scale information (i.e., the reactor level) to understand the details of ANAMMOX reaction occurring in this UAB.

Keywords: ANAMMOX, RTQ-PCR assay, a full-cycle 16S rRNA approach, microelectrodes.

P-34

SUBCRITICAL CRACK GROWTH IN ROCK

Yoshitaka Nara
Graduate School of Engineering, Hokkaido University

Knowledge of the time-dependent properties of deformation and fracture behaviors in rocks is essential to ensure the long-term stability of structures in rock mass, such as underground power plants or sites for radioactive waste disposal. Subcritical crack growth is one of the main causes of the time-dependent behaviors in rocks. Under low homologous temperatures and atmospheric pressure, stress corrosion is the main mechanism of subcritical crack growth in rocks. In silicate rocks, stress corrosion is a weakening process due to a chemical reaction between the siloxane bond structure near the crack tip and water. The author has studied subcritical crack growth in rock and investigated the effects of surrounding environment and rock fabrics on subcritical crack growth.

The relation between the crack velocity and the stress intensity factor was determined by using a fracture mechanics testing method called "Double Torsion (DT) method" and effective agents on subcritical crack growth in rock were investigated. It was shown that subcritical crack growth in granite was anisotropic and affected by the preferred orientation of pre-existing micro-cracks. When the crack growth occurred in the direction parallel to the plane in which the density of pre-existing micro-cracks was the highest, the crack velocity at the same stress intensity factor was the highest in the same environmental condition. Dependence of the crack growth on the water vapor pressure was clarified in air. The crack velocity at the same stress intensity factor increased with increasing the water vapor pressure. It was also clarified that the

crack velocity at the same stress intensity factor and temperature was higher in water than in air.
Preparing thin sections from the rock specimens used for DT test and observing the crack paths, the relation between the geometry of the crack path and the crack growth behavior was investigated by the fractal analysis. It was clarified that the density of pre-existing micro-cracks affected strongly the geometry of the crack path.
Subcritical crack growth was also observed for micro-cracks by raising the temperature and relative humidity of surrounding environment. By the measurement of P-wave velocity in granite with the change of temperature and humidity, the decrease of P-wave velocity was observed when the relative humidity increased under high temperatures. This result is due to the stress corrosion crack growth for micro-cracks.
From this study, the effects of environment and rock fabrics on subcritical crack growth have been clarified quantitatively.

Keywords: subcritical crack growth, stress corrosion, Double Torsion method, preferred orientation of micro-cracks, water vapor pressure, crack path.

P-35

MICROBIAL COMMUNITY ANALYSIS IN PILOT-SCALE MEMBRANE BIOREACTORS TREATING DOMESTIC WASTEWATER

Yuki Miura
Graduate School of Engineering, Hokkaido University

Membrane separation technology is increasingly becoming an important innovation in biological wastewater treatment. Membrane fouling particularly biofouling, is a major factor affecting the efficient and economic operation of membrane bioreactors (MBRs) and properties of biomass (sludge) in the MBR. We therefore, analyzed the microbial community structure of pilot-scale submerged membrane bioreactors treating municipal wastewater by applying a full cycle of 16S rRNA approach including clone library analysis and fluorescence in situ hybridization (FISH) and related to membrane fouling. FISH analysis revealed that the population Chloroflexi, belonging to subdivision 1 and 3, accounted for ca. 24% of total bacteria present in the mixed liquor, and they seem to be a key player in formation of microbial flocs and in degradation of soluble microbial products derived from biomass decay in the MBR. When the population of Chloroflexi decreased, soluble polysaccharide concentrations increased and trance membrane pressure (TMP) also accordingly increased. We further conducted the identification and characterization of this group of bacteria by using microautoradiography combined FISH (MAR-FISH) analysis. It was found that Chloroflexi was able to uptake N-acetyl-[1-14C] D-Glucose (NAG) as a major constituent of bacteria cell wall peptidoglycan and lipopolysaccharide. This implied that they were terminal organic degraders (scavengers) of dead biomass.
In addition, we observed the biofilm attachment and growth on the hollow fiber membrane surface by the SEM, Live/Dead staining and FISH anlysis. The number of active bacteria attached on the membrane surface increased with time, resulting in an increase in TMP. FISH analysis revealed that this biofilm was composed of mainly Betaproteobacteria, accounting for ca. 70% of total bacteria in the biofilm. Furthermore, we analyzed the microbial community structure in this biofilm by 16S rRNA gene clone libraly analysis followed by FISH. In the clone library, most of the clones belonged to only two bacterial lineages: Betaproteobacteria (detection rate; 32/47) and Gammaproteobacteria (detection rate; 8/47), which agreed with the result of FISH analysis. This biofilm microbial community structure was complete4ly different from that in the suspended mixed liquor sample. This indicate that bacteria belonging to the Betaproteobacteria have a special ability to attach to the membrane surface and form mature biofilms.

Keywords: Membrane Bioreactor (MBR) ; membrane fouling ; biofouling ; microbial community ; Chloroflexi ; Proteobacteria ; Fluorescence in situ hybridization (FISH).

P-36

Development of mathematical model for a landfill cell

Sang Yul Kim
Graduate School of Engineering, Hokkaido University

Many studies have been done in laboratory scale or even field scale experiments to obtain detailed information on the fate and transport of pollutants from municipal solid waste (MSW) landfills. However, such studies can only get a result for a specific set of parameters. In this regard, a numerical model can be a powerful tool to understand the behavior of pollutants according to various conditions: time scales, the type of waste, the dimensions of landfill, landfill structure as well as climatological conditions.

In past years, most landfill models were to simulate organic-rich landfills, so these models have addressed the fate of carbon compounds such as acetate, CO2, CH4. And solid calcium carbonate (CaCO3(S)) has been generally used as main buffer mineral in landfill. However, Japan has promoted the incineration of MSW over 30 years. Consequently, the quality of landfilled wastes has been changed from organic waste to inorganic wastes such as incineration residues.

Therefore, we developed a mathematical model of the fate and transport of pollutants from inorganic-rich MSW landfills as well as organic-rich MSW landfills. For this, we considers the precipitates of CaCO3(S), Ca(OH)2, and CaSO4(S) as main buffer mineral in landfills.

Our model is based on compartment model (or a box model), in which one compartment represents a unit cell of the landfill. This allows simulation of a landfill of various cells by using different parameters values in different landfill cells. In addition, the model is able to switch anaerobic conditions into aerobic conditions and vice versa, depending on the local oxygen concentration. Furthermore, the influence of environmental factors, such as moisture content, pH, and temperature on reaction rates has been also incorporated.

Although the validation of model parameters is needed by applying to various field data, simulation results show a typical pattern of biogas and leachate composition as observed in actual landfill sites. In the near future, the model is scheduled to be improved by validating model parameters with field data, by including chemicals such as heavy metals and dioxins, and by expanding the one cell model to a multi-cell model to simulate actual landfilling operations and different structural designs.

Keywords: mathematical model, landfill, pollutant, simulation, municipal solid waste (MSW).

P-37

HUMAN DNA MICROARRAY ANALYSES FOR THE EVALUATION AND DIFFERENTIATION OF HEAVY METAL TOXICITY

Koji Kawata
Graduate School of Engineering, Hokkaido University

Current approaches to risk assessment of toxic chemicals focus on a single end point and are inadequate for the evaluation of environmental water including a large number of unspecified substances. DNA microarray technology, which makes it possible to analyse chemically induced alteration of gene expression, has become an important technique in toxicology and may provide new multiple bioassay method for detection of environmental chemicals. In this study, we evaluated and differentiated the toxicity of seven heavy metals on the basis of tentative elemental toxicity: oxidative stress, protein denaturation, and carcinogenesis through a comparison of the gene expression profiles in human hepatoma cell line, HpG2. Using 8795 gene array, gene expression changes following high-dose exposures (60-80% cell viability after 6 hr treatment) of arsenic, cadmium, mercury, chromium, nickel, antimony or manganese were examined along with those of model chemicals: hydrogen peroxide (oxidative stressor), phenol (protein denaturing agent), 12-O-tetradecanoylphorbol-13-acetate (TPA, tumor promoter), dimethylnitrosamine (DMN) or mitomycin C (MMC, tumor initiator). As the result of t-test with $p<0,05$, a total of 1230 genes with treatment : control ratios ? 2.0 or ?2.0 were identified. The hierarchical clustering analysis showed that gene expression profiles after exposure of five heavy metals (As, Cd, Hg, Cr, Mn) were closely related to that of H2O2, while the expression patterns induced by Ni and phenol were grouped together. These results suggested that high-dose exposure of five heavy metals and Ni induce oxidative stress and protein denaturation respectively. We further examined the dose-dependent toxicity of arsenic. The gene expression pattern induced by low-dose (78% cell viability after 48 hr exposure) arsenic was significantly different from high-dose exposure and closely related to three carcinogens (TPA,

DMN, MMC). Thus, comparison of gene expression profiles, using DNA microarray allowed us to evaluate and differentiate heavy metal toxicity. This method has potential for predicting the major toxicities caused by chemicals in water environment and will provide information about toxic risks in humans.

Keywords: DNA microarray, heavy metal, oxidative stress, protein denaturation, carcinogenesis.

P-38

Recovery of nitrogen from source separated feces and urine in onsite wastewater differentiable treatment system

Shinya Hotta

Graduate School of Engineeing, Hokkaido University

Source separation of feces from urine has been studied to improve the present issues in Bio-toilet system that is the key technology in Onsite Wastewater Differentiable Treatment system (OWDTS). We need to apply urine diverting composting toilet system (UDCTS) to treat human waste in OWDTS. Source separated feces is treated in the sawdust matrix as conventional. Source separated urine is stored in urine storage and treatment unit (USTU). It is still not studied well in literatures how we recover the nitrogen from feces and urine in UDCTS. The aim of this study is to provide basic knowledge and to contribute the discussion for the nitrogen recovery from human waste in decentralized wastewater treatment system.

We have two topics in this study: Topic 1) we need to characterize feces nitrogen in the composting material for a control of the recovery rate of nitrogen. Topic 2) the hydrolysis of urea in stored urine should be controlled for higher recovery rate of nitrogen. Urea hydrolysis proceeded by the activity of urease producing bacteria (UPB) from feces. We therefore focused on the fate of the UPB by feces contamination in the toilet bowel in UDCTS. The UPB in contaminated urine by feces (2g-feces/l-urine) was indirectly estimated: the UPB was described by ammonification rates. According to the theory for enzyme reaction, ammonification rate could be determined by three factors without inhibition factor: reaction temperature, concentration of urea and concentration of the UPB.

It was cleared that feces contained the 75% of NXS (biodegradable) and 25% of NXI (originally inert), and 9% of NXIB (inert produced by endogenous respiration) respectively. We therefore concluded that approximately 34% (sum up of NXI and NXIB) of feces nitrogen can be recovered from the composting toilet. We found that the urea hydrolysis depended on the UPB concentration and effect of inhibition factor. However it was not cleared nitrogen recovery rate from stored urine. We still need to study the inhibition factor by NH3(aq) for the UPB to control the urea hydrolysis for stable condition in stored urine.

Keywords: nitrogen recovery, composting toilet, source separation, nitrogen transformation during the composting process, urea hydrolysis

P-39

Development of the prediction models of concrete structure for structural performance during service life

Kiyofumi Kurumisawa

Graduate School of Engineering, Hokkaido University

The objective is constructing the deterioration model of the concrete structure. Moreover, the durability of the concrete structure that will be constructed in the future is predicted, and an appropriate design and the repair time are clarified. It approaches from the materials level that composes concrete. The deterioration prediction model from the microstructure model with the cement-based materials is constructed, and it proposes the best material and the design for construction. Especially, the permeability and diffusion of the cement-based materials that greatly influences deterioration is examined, and the mechanism is clarified from microstructure.

For this purpose, the technique that the amount and the distribution of each phase in hardened cement paste is evaluated by using backscattered electron image and the element image measured by energy dispersive X-ray analysis, was developed. Moreover, it was also cleared the microstructure of cement paste mixed with fly ash and the blast furnace slag applying this technique. In addition, the technique for predicting the elastic modulus by using the phase distribution image was developed. And the technique that the amount and the distribution of pores in hardened cement paste are evaluated by using

Gallium intrusion method with electron probe microanalysis, was developed. It is cleared that chloride penetration depth of hardened cement paste is evaluated by this method.
To evaluate the amount of chloride in a concrete structure existing by nondestructive because the deterioration diagnosis of an existing building is very important, we developed the prediction method of the difference of the amount of chloride contained in concrete by using the spectrum analysis of the received waveform of the electromagnetic radar.

Keywords: Concrete structure, Durability, Microstructure, Hydration, Transport, Elastic behavior

P-40

Development of analytical model for predicting deterioration process coupled with heat, moisture and substances transfers and chemical reactions of various concretes

Yoshihiko Kishimoto
Graduate School of Engineering, Hokkaido University

Neutralization of concrete occurs as a result of CO2 gas from the air dissolving in the absorbed water, which contains alkaline substances such as Ca(OH)2. Therefore, the ad- or absorbed water is essential to neutralization, and the rate of the neutralization strongly depends upon the moisture regime. When a concrete wall is exposed to rain, it is generally believed that the neutralization is slow because CO2 gas cannot diffuse into concrete. Although rain is assumed to be pure water, rain in Japan is usually acid with a pH of less than 5.6. In this situation, neutralization may proceed faster because CO2 has already dissolved in the atmosphere, and the acid substances can move due to advection of the solution.
From this point of view, permeability is one of the most important parameters in discussing the neutralization of a concrete wall. Furthermore, if the permeability varies depending upon the position in the wall, the neutralization rate may also differ from place to place.
In this study, the permeability of concrete was measured at atmospheric pressure in order to clarify the vertical distribution. The measured result in a test piece with 20 cm height showed clearly a non-uniform vertical distribution of the permeability. The water permeability in the upper part was about two times larger than that in the center part.
Next, a neutralization process in a small-scale concrete wall was simulated under cyclic infiltration of rain and drying, with an assumed vertical distribution of water permeability. The results showed that neutralization was accelerated due to acid rain in regions with a high permeability and retarded in regions with a low permeability. Thus, it can be concluded that the influence of acid rain on neutralization process may differ depending on the position in concrete structure.
After this, proposed analytical model will be extended for application to concrete treated with silane agent, and recycled concrete.

Keywords: concrete, durability, water permeability, advection, chemical reaction

P-41

Feasibility Study of a Low Energy System Utilizing Urban Exhaust Heat With Ground Water as Medium of Thermal Transport

Takao Katsura
Graduate School of Engineering, Hokkaido University

In order to recreate utilizable water resource and maintain area based society, it is necessary to establish small-sized sewage-disposal plants, which can release treated sewage into closed-hand area. In addition, it is possible to utilize exhaust heat from black water by construction of the sewage-disposal plants. As the method, for example, a system utilizing ground water as medium of thermal transport, which cultivates treated sewage into the ground and recovers the exhaust heat in the downstream, is suggested. Since there are a lot of heat demand for heating and hot water supply, to construct such a system is effective from the viewpoint of energy saving, especially cities in the cold region like Sapporo.
In this paper, in order to evaluate the system, a method to calculate ground temperature with ground water flow s shown based on comparing the thermal response for cylindrical heat source calculated by numerical calculation with one for line heat source calculated by the moving line heat source theory.
Next, the outline of the system is proposed and the feasibility study is carried out with the tool including developed

method.

Keywords: Urban Exhaust Heat, Ground Thermal Energy System, Feasibility Study, Design Method, Ground Water Flow

P-42

OPTIMAL SPEED LIMIT BY COST ANALYSIS

Suthipun Thanesuen
Graduate School of Engineering, Hokkaido University

This study is aimed at determining the optimal speed limit for dry summer conditions on Hokkaido roads by using cost analysis including the effects from traffic signal intensity and traffic congestion. In the cost analysis, the components that were involved include time cost, vehicle operating cost, pollution cost, and accidental cost. The unit here was in yen per kilometer per day. Initially, traffic volumes on Hokkaido roads were determined. Then, the relationships between average speed and each cost component was calculated. After that, the summations of overall costs of each average speed were verified so that the optimal average speeds were obtained from the minimum total costs. Then, the effects from traffic signal intensity and traffic congestion were required to calculate the optimal speed limit from the optimal average speed. Finally, the optimal speed limits were obtained, i.e. 60 km/h on urban national highways, 70 km/h on rural national highways, and 90 km/h on urban and rural expressways. This is in contrast to the current existing speed limits of 50 km/h on urban national highways, 60 km/h on rural national highways, and 80 km/h on urban expressways and 100 km/h on rural expressways. In conclusion, it was shown that traffic congestion had less of an effect on average speed due to the low traffic volume of Hokkaido roads. From the cost analysis, time costs and accidental costs had major effects on the results. As the cost analysis included all major components for determining optimal speed limit, these new speed limits can contribute towards improved road safety, increased energy efficiency and a healthier roadside environment. Eventually, as a practical measure, public hearings are necessary to support the new speed limits which are also included in the further study.

Keywords: optimal speed limit, cost analysis, traffic signal intensity, traffic congestion

P-43

Characteristics of irreversible membrane foulant in Ultrafiltration of surface water

Hiroshi Yamamura
Graduate School of Engineering, Hokkaido University

Water treatment using microfiltration (MF)/ultrafiltration (UF) membranes are gaining in popularity all over the world. Although use of membranes in drinking water treatment has various advantages, a major drawback associated with this technology, membrane fouling, has not been addressed yet. Membrane fouling can be divided into two types: reversible fouling and irreversible one. The former can be defined as the fouling that can be cancelled by physical membrane cleaning, whereas the latter needs chemical membrane cleaning to be canceled. Currently, there is still a lack of information as to which constituents contained in feed water would cause irreversible fouling and therefore it is not possible to establish an efficient way to prevent it. In this study, to obtain the information about the constituents that would cause irreversible fouling in/on Polyacrylnitrile membrane (molecular weight cut-off: 100,000 Da), pilot studies were conducted for 30 days from the beginning of October, 2005. As expected, the development of irreversible fouling was observed in increase in trans-membrane pressure in spite of conducting the physical cleaning routinely. After 30 days of continuous operation, to elucidate what constituents caused the irreversible fouling, membrane specimens were taken out from the pilot unit and various types of chemical cleaning were examined. A series of chemical cleaning demonstrated that acid or chelate worked better in flux recovery, whereas sodium hydrate was not effective. This result implied that irreversible fouling might mainly induced by inorganic matter. Based on the chemical analysis, HCl extracts contained a large amount of iron. Consequently, it was found that one of the major foulant that caused irreversible fouling in this study was iron. Also interestingly, not only iron but also a large amount of organic matter was desorbed by HCl solution. The FTIR spectra of the foulants contained in HCl solution exhibited a large carbohydrate peaks around 1080 cm-1, which indicated that carbohydrate could be pointed out to be one of the major foulant as well. Therefore, it could be considered as fouling mechanisms that (1) complexes of iron and carbohydrate plug the macropores or (2) iron and carbohydrate accumulated on/in the

membrane, respectively.

Keywords: Ultrafiltration, Irreversible membrane fouling, iron, carbohydrate

P-44

LIFE PREDICTION FOR CONCRETE UNDER FATIGUE LOADS AND FREEZING-THAWING CYCLES

Koji Matsumoto
Graduate School of Engineering, Hokkaido University

Background

In order to develop sustainable infrastructure system, rational design method for structures against long-term deterioration is required. Hence, we should know when and how structures are damaged and improvement of current life-prediction methods is required. This study focuses on fatigue and frost damage, which are typical deterioration of concrete structure. The aim of this study is to develop new design method, which can consider deformation, damage distribution and combined effect of fatigue and freezing-thawing action during structural service life.

Research plan

This study is composed of five stages. As the first step, macroscopic constitutive model of concrete under fatigue loading is developed. Secondly, mesoscopic fatigue analysis system using Rigid Body Spring Model (RBSM) will be developed. Here, time-dependent mesoscopic constitutive law is proposed. Thirdly, freezing-thawing analysis system using RBSM with truss network will be developed. Here, mesoscopic damage is related to water and temperature change in concrete based on microscopic structure. At the fourth step, both the analytical systems will be combined, and then deterioration of concrete under combined action of fatigue and freezing-thawing can be simulated. Lastly, fatigue life prediction formula, which can take frost damage into account, will be developed for design purposes.

Macroscopic deformational model under fatigue loads (STEP1)

Fatigue loading tests were carried out and they were analyzed with previous experimental data. This activity corresponds to the first step. As a result of summarizing and organizing the experimental data, it was found that concrete under fatigue loading has non-damaging strain as well as damaging strain. Besides, stress-strain model was developed, and then deformation of concrete under fatigue loading could be numerically expressed. However, remaining issue was found, which is, amount of time-dependent plastic strain has not been quantitatively expressed under macroscopic level.

Time-dependent analysis of mortar by RBSM (STEP2)

Time-dependent analyses of mortars by RBSM were carried out as a basic study of fatigue analysis. In general, there are two visco-elastic models, which are Maxwell and Voigt model. In this study, characteristic of each model on results of RBSM analysis were examined through mortar analyses. Consequently, differences of strength and stiffness change from static case between Maxwell and Voigt model were found.

Keywords: concrete structures, life-prediction, fatigue, freezing-thawing, combined action, mesoscopic analysis

P-45

Fate of Pharmaceuticals in Human Excrement During the Composting Process of Feces

Takashi Kakimoto
Graduate School of Engineering, Hokkaido University

We have proposed the Onsite Wastewater Differentiable Treatment System. In this system, household wastewater is separated into three fractions (blackwater, higher load graywater, and lower load graywater), and each is treated separately. The blackwater that may contain pharmaceuticals (PhACs) is treated by a composting toilet using sawdust as a matrix. Our objective in this study is to understand the fate of PhACs in the composting process varying the feces loading ratio on the toilet reactor. The variation of oxygen utilization rate (OUR) indicated the degradation rate of feces in the composting process, and the OUR profiles showed that feces were almost treated in early stage of this process. We also observed the decay of the selected PhACs in this process. The reduction profiles imply that the degradation of PhACs has small relation to the treatment of feces. The degradation rates of all PhACs were almost the same if the feces loading ratio was 5%, and the degradation rates of acidic PhACs were almost the same regardless of the increasing of the feces loading ratio.

But the higher feces loading ratio gave higher degradation rates of basic PhACs. During the process higher feces loading ratio gave the higher ammonia concentration in the sawdust matrices and this resulted in higher pH value. In this experiment, the pH ranged from pH7 to pH9 and in this pH range, acidic PhACs are present as an ionic form. At pH 7, the basic PhACs exists as an ionic form, but at pH 8.5 and 8.8, where we observed the rapid degradation of the basic PhACs, about 10% of the basic PhACs exists as non-ionic form. Therefore we infer that the degradation of the selected PhACs is affected by the dissociation condition. To conclude this study, we obtained following knowledge; (1)Easily biodegradable organic matter (like feces) does not interfere the degradation of the PhACs; (2)The structural difference among the selected PhACs in this study gives insignificant effect on the degradation rate; (3)The dissociation condition may have a significant effect on the degradation rates in the composting process.

Keywords: Composting process, Degradation of Pharmaceuticals, Treatment at source

P-46

Simultaneous Power Production and Wastewater Treatment Using a Microbial Fuel Cell

Kyung mi Chung
Graduate School of Engineering, Hokkaido University

A microbial fuel cell (MFC) converts chemical energy, available in a bio-convertible substrate, directly into electricity. To achieve this, bacterial are used as a catalyst to convert substrate into electrons. Electrons are transferred through an external circuit while the protons diffuse through the solution to the cathode, where electrons combine with protons and oxygen to form water. The objective of this study is to optimize the operation conditions of MFC for simultaneous power production and wastewater treatment.
In this work, the MFC comprised anode and cathode chambers. Between the compartments, a Nafion proton exchange membrane was installed. Glucose (5 mM) was used as carbon source and loading rate was 2.0 ml/min. Electrodes of anode and cathode were consisted of woven graphite. The anode was continuously purged with nitrogen gas to maintain anaerobic condition, while the cathode was sparged with air. Current (I) was calculated at a resistance (R) from the voltage (V) as I=V/R. Power was calculated as P=IV.
Power generation was measured using a series of resistors (1-100000 Ω) to determine the maximum power output as a function of current. The highest power density of 5.0 mW/m2 was achieved at the current density of 23.5-26.0 mA/m2, which was obtained with the resistance of 900 and 800 Ω, respectively. The maximum coulombic efficiency was 11.6 % with a resistance of 500 Ω. The DOC removal rate was 30%. These results suggested the possibility of using MFC to generate electricity and simultaneously treat wastewater, but further progresses in the design and operation of MFC are required in order to accomplish greater overall MFC performance.

Keywords: microbial fuel cell, power density, current density, coulombic efficiency

P-47

Complexation Reactions of Anions on Hydrotalcite Surface

Kazuya Morimoto
Graduate School of Engineering, Hokkaido University

Hydrotalcite is one of the naturally occurring minerals with a formula of [Mg1-xAlx(OH)2] [An-x/n·yH2O]. An- denotes an anion of which the valence is n. It comprises positively charged brucite-like octahedral layers and interlayers filled with anions and water molecules. The positive charge in the octahedral layers is formed by partial substitution of Al3+ for Mg2+. Stacking of the layers occurs and the balancing interlayer anions can be exchanged.
Recently, hydrotalcite has received considerable attention in a variety of fields because of their considerable anion-exchange capacity. It has been used as a sorbent in the removal of various pollutants in aqueous solutions. The mechanism involved has not yet been elucidated specifically surface complexation reactions. This study focuses on anion sorption mechanism in hydrotalcite with a specific regard on surface complexation reactions.
Chloride, nitrate, carbonate, sulfate, phosphate and silicate ions are the sorbates considered in the experiments. Zeta potential and pH measurements were used to monitor the sorption reactions with these ions.

The change in zeta potential of hydrotalcite in distilled water is similarly observed in chloride and nitrate-sorbed hydrotalcite in this study. It indicates that chloride and nitrate ions inspired simply sorption by anion-exchange reaction onto hydrotalcite because that reaction has little influence on zeta potential.
On the other hand, the zeta potential trends for carbonate, sulfate, phosphate and silicate-sorbed hydrotalcite are in contrast. These exhibited lower zeta potential values which would suggest that the point of zero charge (PZC) also shifted to lower pH compared to a pHpzc of more than 11 for hydrotalcite in distilled water. These results suggest that the ions considered in this study formed inner-sphere surface complexes on hydrotalcite surface probably via ligand-substitution reaction. Such reactions are expected to change the physico-chemical properties of hydrotalcite (i.e. increased or decreased stability).
Hydrotalcite has two possible sorption sites indicating that sorption mechanism would vary for different anion species.

Keywords: Hydrotalcite; Sorbent; Zeta potential; Complexation reactions

P-48

Weathering resistivity interpreted from the textures of plutonic rocks

Kouki Kashiwaya
Graduate School of Engineering, Hokkaido University

Void structures observed in weathered Inada granite and Kuroishiyama gabbro were examined using quantitative methods such as multifractal analysis, pore size distribution measurement, and effective porosity measurement. And values characterizing the void structures were correlated with uniaxial compressive strengths (UCS) to reveal the weathering resistivity of the plutonic rocks.
Slope of q-Dq-UCS curved surface showing a relationship of generalized dimension spectra and UCSs is steeper in the granite. It means that the UCS of the granite decreases more drastically than the gabbro when their heterogeneities increase similarly.
The granite has granular texture. Continuous and linear void structures occur through weathering, and their fracture density is relatively small. That is why the void structures in the granite largely contribute to the decrease in UCS but influence on the heterogeneity of the void structure is not so strong. On the one hand, the gabbro is characterized by poikilitic texture. Intra-granular fractures in plagioclase are densely distributed and contribute to the increase in the heterogeneity of the void structure. However, the skeleton of amphibole is not so affected by weathering and thus the strength of the gabbro is maintained.
The results show that the UCS of the granite decreases more easily by weathering than the gabbro when the two plutonic rocks are compared based on their void structures. This indicates that the gabbro has higher weathering resistivity than the granite even though the granite is composed of minerals which have relatively high weathering resistivity such as quartz, and it is attributed to their microscopic void structures.

Keywords: weathering, void structure, multifractal analysis, plutonic rock

P-49

Chloride ion diffusion coefficient of stressed fiber reinforced concrete under loading conditions

Yuki Sakoi
Graduate School of Engineering, Hokkaido University

To examine the chloride penetration into concrete is one of the most important to assess the durability of concrete structures. The concrete structures are always subjected to various loads, prestressing as well as traffic, earthquake and so on. Many cracks exist in the stressed concrete, and it is considered that these cracks accelerate the deterioration caused by chloride ion or other substance penetration. However, only few attempts have been made so far for the chloride penetration into concrete under loading condition. Therefore, it is needed for the durability of concrete structures to examine the effect of loading for the chloride penetration into concrete.
In addition, admixing short fibers into concrete can improve the properties of concrete. As a result of admixing fibers, the concrete can alter development of crack that was caused by loading or environmental effects. Therefore, it is considered

that the chloride penetration into concrete can be reduced due to the mix of short fibers into concrete.
In this study, the chloride penetration into short fiber reinforced concrete under several loading condition was examined. From the results, it was found that the chloride diffusion coefficient (Dnssm) reduced at low stress level under static compressive loading condition, and the Dnssm at around 50% stress level changed to increase, and then the Dnssm increased with the increase of static compressive loading level after that. On the other hand, the change of Dnssm under tensile loading was differed from that under compressive loading level. The Dnssm subjected to tensile stress showed the increase with the increase of tensile stress level after subjected to low tensile stress.
The change of Dnssm for short fiber reinforced concrete showed almost same behavior under both loading conditions, however, the change ratio of Dnssm with the change of stress level differed from that of non- fiber concrete. And it was found that mixing short fibers into concrete could lead to the improvement of chloride penetration resistance under loading conditions.
From these findings, it was confirmed that loading affects the chloride penetration into concrete. And it was suggested that mixing short fibers into concrete could improve the durability of concrete structures due to the increase in resistance of chloride penetration.

Keywords: Short Fiber Reinforced Concrete, Chloride Ion, Diffusion Coefficient, under Loading

P-50

THE CONTRIBUTION OF RPOS TO FORMATION OF ESCHERICHIA COLI BIOFILMS

Akinobu Ito
Graduate School of Engineering, Hokkaido University

It is now apparent that microorganisms undergo significant changes during the transition from planktonic to biofilm growth that possess enhanced resistance to various stresses such as chlorine treatments and antimicrobial agents. It has been suggested that the creation of starved, stationary phase zones in biofilms seems to be a significant factor for biofilm formation. In this study, the role of rpoS gene in Escherichia coli biofilms was investigated which is known to be expressed during entry into stationary phase and stress conditions. To assess the importance of rpoS gene for biofilm formation, we used E. coli MG1655 rpoS mutant strain to perform flow chamber experiment. We found that the rpoS mutant can only form thin biofilms. To further assess the role of the rpoS gene in E. coli, we performed DNA microarray analysis, and it revealed that gene expression pattern of rpoS mutant was different from that of wild type strain. In stationary phase, 193 genes were significantly down-regulated in rpoS mutant, which included genes induced in starvation conditions, genes encoding heat shock proteins, genes induced at high temperature, and osmotically inducible genes. These results suggest that the rpoS mutant is less capable of response and adaptation to stresses than the wild type strain in stationary phase, which might be the reason for the formation of only thin biofilms. In addition, they also suggest that the rpoS mutant shows too much motility even in the stationary phase. It could explain the presence of the actively moving and rotating cells in the early stages of biofilm formation, which might be the reason for E. coli rpoS mutant to be incapable of establishing mature biofilms. Based on these results, we concluded that rpoS gene which is induced in the stationary phase and stress conditions is important for formation of mature biofilms.

Keywords: biofilms, gene expression, rpoS, Escherichia coli, stress response

P-51

Evaluation of char derived from solid waste for fuel recovery and final disposal in landfill

In-Hee Hwang
Graduate School of Engineering, Hokkaido University

Carbonization is a kind of thermal treatment process to produce carbonaceous materials, so-called char, under inert atmosphere. In this work, chars derived from various municipal and industrial solid wastes were evaluated from the standpoint of fuel recovery and thermal pretreatment before landfilling.
The quality of char as a fuel definitely depends on the composition of input wastes. The higher the ratio of woody biomass in raw wastes, the better the quality of the char produced. The estimation equation of char heating value by

using its weight fraction of fixed carbon (FC) and volatile matter (VM) was derived; estimated heating values showed a good correlation with measured ones (R2=0.957). Regarding quality improvement of char, the pulverization and sieving method effective in separation of incombustibles rather than ash. From the application of coal cleaning or separation techniques (ex: sink-floatation, froath floatation, and oil agglomeration in liquid) for ash removal from char, char particles existed as compounds of combustibles and ash. Moreover, char particles have a tendency to coagulate in water. These characteristics indicate that wet separation using an aqueous solution likely reduces efficiency due to particle coagulation. Further ash separation should be studied for improving char quality. On the other hand, most char met a 0.5 wt% chlorine criterion allowing it to be utilized as shaft blast furnace fuel after water washing.
Carbonization has an excellent effect on reduction of organic matter disposed in landfills. Releasing of heavy metals such as chrome, cadmium, and lead decreased remarkably by carbonization regardless of the type of raw waste at JLT-13 leaching test. However, it was found that metal leaching from carbonization residue could be changed somewhat by landfill environment such as aerobic or anaerobic condition through column tests.
From these results, carbonization might be considered as a feasible option for pre-treatment before landfills, as well as for fuel recovery.

Keywords: Carbonization, char, quality improvement, pre-treatment for landfilling

P-52

Advanced Application of Jig Separator for Plastic Material Recycling

Kunihiro Hori
Graduate School of Engineering, Hokkaido University

Development of mechanical separation of different plastics is essential in planning and constructing a recycling plant that processes scrapped electric appliances or automobiles. The authors have improved TACUB jig as a plastic separator. Jig separation for plastics of smaller sizes (0.5-3 mm) but similar specific gravities was performed using polyvinyl chloride (PVC), polyethylene (PE), acrylonitrile butadiene styrene (ABS), and acrylicplastics from scrapped plastic rods and electric wires. At the minimum difference in the specific gravities of 0.03, a higher grade product over 99% was still obtained. The pulsation of frequency and amplitude for smaller size plastics is lesser than that for coarser plastics. Based on the results, jig separator was applied to the following process.
For the plastics from scrapped copy machines containing polystyrene (PS),ABS, and polyethylene terephthalate (PET), high grade (>99%) of each plastic was recovered in the two cells of the jig, where PET is recovered from the first cell as bottom product, and ABS and PS from the second cell as bottom and upper layer products, respectively. Their sizes ranged from 3.5-10mmand their specific gravities were 1.03, 1.22 and 1.71 for PS, ABS, and PET respectively. Based on the results a recycling plant for processing scrap office and home appliances had been constructed.

Keywords: Jig, Gravity Concentration, PVC, Waste Plastics, Recycling

P-53

Value material collection by wet process sorting method from various shredder dusts

Yutaka Kuwayama
Graduate School of Engineering, Hokkaido University

----no abstruct

P-54

Sustainable Development

Stephen Lincoln
School of Chemistry and Physics, University of Adelaide

A flow chart is presented which shows a model of the interdependencies in sustainable development which may be used in education. The model is centered on population. Current projections suggest that population will level out about 10 billion a little before 2100 and that a decline will occur thereafter. In seeking to sustainably support the present population and its anticipated growth many interdependent factors must be considered [1]. These factors are collected into four major components for convenience: water, food, energy and disease. The interdependence of these components occurs through a wide range of factors exemplified by deforestation, climate change, biodiversity, zoonolysis, biotechnology, fertilizer use, fossil fuel use and alternative energy sources. These considerations are presented in a pattern useful for giving an overview of sustainable development to students at universities.

[1] S.F. Lincoln, Challenged Earth: An Overview of Humanity's Stewardship of Earth, Imperial College Press, London, 2006.

P-55

Point and Non-point Source Pollution of Dahuofang Reservoir Catchment Based on a GIS Model and Its Integrated Water Management

Tao Hua
College of Environmental Science and Engineering, Nankai University

As a strategic and critical surface water resource for the Liao River basin, Dahuofang Reservoir is also an important water resource for Shenyang in Liaoning Province.China. However, in recent years, eutrophication has been reported in its water due to both point and non-point source pollution.

This research was performed to identify the main factors influencing its water quality. In this research, an ArcView hydrology extension script was employed to construct a point and non-point source pollution model based on basic information that has been collected.

The current situation and the future tendency of water pollution in the catchment were identified and suggestions were proposed to enhance the integrated water management which aims to improve the water quality for Dahuofang Reservoir.

P-56

Soil organic carbon, nitrogen and microbial biomass under Larix gmelinii forest in different latitude of Northeast China

Fuchen Shi
College of Life Sciences, Nankai University

Larix gmelinii forest plays a very important role in both environmental protection and economic development in northern China. We compared soil organic carbon (SOC), nitrogen (N), and microbial biomass in L.gmelinii forest along the latitude in northeast China. Surface SOC, total N and microbial biomass of soil samples collected from L. gmelinii forest along the latitude grads ascending decreased significantly. Surface SOC content decreased from 10.56% to 5.30% along the latitude, and N decreased from 0.88% to 0.29%. In surface soil, the highest microbial biomass carbon (MBC) was 4805.16 mg/kg which located in N44° 22′ , and the lowest MBC was 161.49 mg/kg which located in N53° 33′ . Surface soil microbial biomass nitrogen (MBN) also varied from 1038.54 mg/kg to 99.55 mg/kg with latitude ascent. The ratios of microbial biomass to SOC and N In the southern study sites were significantly higher, when compared to the northern study sites' ones. Differences among sites became less pronounced in subsoil. There were positive and significant correlations between SOC, total N and microbial biomass. The study showed that the tested soil characteristics, both abiotic and biological, significantly liner correlated with the latitude.

Keywords: Larix gmelinii; Latitude; Soil organic carbon and nitrogen; Microbial biomass

P-57

Sustainable production in aquaculture: innovation of closed recirculation aquaculture system and its ripple effects

Rie Goto-Kazeto [1], Etsuro Yamaya [1], Yasuaki Takagi [2]
1/Nanae Fresh-Water Lab, Field Science Center for Northern Biosphere, Hokkaido University,
2/Graduate School of Fisheries Sciences, Hokkaido University

The present human industrial activities have great impacts on our environment through emissions of carbon dioxide and other chemical pollutants. Such 'environmentally high-cost' human activities now threaten sustainability of our food production. This general undesirable formula is also applicable to the present fishery production.
In 2003, total fishery production was reported to be 132.2 million tones, of which 41.9 million tones from aquaculture practices and 90.3 million tones from capture. Because of decreasing and/or conservation of fishery resources, aquaculture production has been extremely growing compared to capture, about 67 % growth in volume from 1990 to 2003. However, present aquaculture operations (open water system) have serious environmental impacts, such as water pollution by wasted feeds and feces. Although aquaculture production in the last decade has given it increased importance in the modern food supply, there are growing needs to introduce environmentally low-impact system for sustainable food production.
Recently, closed recirculation aquaculture system is concerned as most desired technology for future aquaculture. There are a lot of benefit of environmental preservation, cost saving and prevention of fish diseases. Further more, in spite of global climate change or regional weather change, stable production is engaged in this system. However, a lot of issues appear to be resolved to practically introduce this system. For one, closed recirculation system are much more expensive to construct, install, and maintain than the open water system.
In this study, the issues of introducing closed recirculation system will be raised and discussed from the aspect of fisheries, environmental sociology and international economics.

P-58

Science, participatory research and sustainable land use

William Smith
The University of Auckland

Illustrating on-going research to integrate science into decision-making by farmers on sustainable land use.

P-59

A Study on the Wetland Dynamic and Its Relation with Cropland Reclamation in Sanjiang Plain, China

Kaishan Song, Dianwei Liu, Bai Zhang, Zong Ming Wang, Cui Jin, Yuedong Guo
Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences,

Using remote sensing interpretation, we obtained four periods of land use data sets from 1976 to 2005. Based on these data sets, this study analyzed the dynamics of the wetland land cover and the conversion between wetland and other land use types of Sanjiang Plain in the past 30 years with GIS spatial analysis. It shows that the wetland in Sanjiang Plain has been severely damaged; the wetland area decreased by 37.72% from 1976 to 1986, by 15.54% from 1986 to 1995, and by 30.97% from 1995 to 2005, which shows that the situation of wetland loss had much slowed down in1986 to 1995, but in recent years, the reclamation speed still very high. It was showed by conversation matrix that most wetland losing was the result of reclamation, and only small part of lost wetland was converted into grassland and forest. Still, it found that cropland contributed the main part for wetland area increasing for aimless reclaimed cropland was converted into wetland during flood inundation. Both demographic and resource management policies reason were analyzed for the wetland reduction. The result showed that population increasing was the main reason for wetland reduction in the past decades since P.R. of China foundation. Though the speed of wetland loss decreased during the later period, the reclamation of wetland still happened, so the practicable protection measurement of the wetland in Sanjiang Plain should be reinforced further.

Keywords: Wetland, Sanjiang Plain, remote sensing, GIS

P-60

Salinized wasteland monitoring in Daan County, Northeast China, Using GIS and remote sensing

Zong Ming Wang, Bai Zhang, Kaishan Song, Xiaoyan Li, Ming Chen, Jianping Li, Fang Li, Hongtao Duan
Department of RS and GIS, Northeast Institute of Geography and Agricultural Ecology, Chinese Academy of Sciences

Western part of Northeast China has suffered substantial land degradation during past decades, due to human impact under climatic variations. We presents an integrated study of expansion process of salinized wasteland in Daan County, a typical salt-affected area in Northeast China, by using Geographical Information System (GIS) and remote sensing. Our study explored that, from 1954 to 2004, the salinized wastland in study area have increased by 135995 ha, and now cover 32.31% of the total area, in the meantime grassland has decreased by 104697 ha and covers only 13.15% of land area. Grasslands, croplands and swamplands were found the three main land use types converted into salinized wasteland. Land use/cover changes show that between 1954 and 2004, 48.6% of grasslands, 42.5% of swamplands, and 14.1% of croplands were transformed to salinized wasteland, respectively. Lastly, the major factors influencing salinized wasteland expansion and land use/cover changes are also explored. In general, climatic factors supplied a potential environment for soil saliniztion. Human-related factors, such as policy, population, overgrazing, and intensified and irrational utilization of land and water resources are the main causes of salinized wasteland expansion.

Key words: Salinized wasteland expansion; Land use change; GIS; Remote sensing; Daan County, Northeast China

P-61

International trade of Recyclable Resources in Thailand

So Sasaki
Japan Society for the Promotion of Science

Recently, in Asian Regions there has been active trade of Recyclable Resources. Several Studies have been made on International trade of Recyclable Resources from Japan to China, but little is known about that other Asian countries. This paper is intended as an investigation into International trade of Recyclable Resources in Thailand and the efforts of the Thai government. As a result, it has been understood as follow. First, Thailand was received the influence of the demand for Recyclable Resources in China. Second, there are some second-hand goods import limitations in Thailand. However, third, Thai government is doing flexible correspondence to International trade of Recyclable Resources under certain conditions. To put it briefly the concept of International trade of Recyclable Resources in the future, Thailand shows some suggestive cases.

P-62

Biotechnology Innovations and Patent Protection

Dae Hwan Koo
College of Law, Seoul National University, Korea

Is patenting biotechnology desirable to encourage biotechnology innovations in the light of economic perspective? To answer to this question, it is necessary to consider both the characteristics of biotechnology innovations and the impact of patenting biotechnology (e.g. DNA, gene fragments, etc) to the biotechnology industry as well as the international relationship between developed and developing countries.

P-63

Temporal Variability of the Volume Transport through the Korea Strait and the Tsugaru Strait and the Tsugaru Strait

Hanna Na [1], Kuh Kim [1], Shoshiro Minobe [2]
1/School of Earth and Environmental Sciences, Seoul National University,
2/Division of Earth and Planetary Sciences, Graduate School of Science, Hokkaido University

The volume transports (VT) through the Korea Strait and Tsugaru Strait are estimated from linear regressions between

transport data and the sea level difference (SLD) across the straits. As the sea level data along the Korean and Japanese coasts have been measured for several decades, the VTs can be estimated for a long period during which the sea level data are available. For the Korea Strait the SLD was calculated between Pusan and Moji. The transport data by the submarine cable was used to get the conversion equation from the SLD to the VT (Lyu and Kim, 2003). The atmospheric pressure effect and the baroclinic part of SLD were removed before computing the conversion equation. For the Tsugaru Strait Tappi and Yoshioka were selected to calculate the SLD. The conversion equation for the Tsugaru Strait was obtained by using the transport data from the vessel mounted ADCP (Ito et al., 2003). The mean value of the VT from 1984 through 2004 is 2.5 Sv for the Korea Strait and 1.5 Sv for the Tsugaru Strait is 1.5 Sv. It is found that variance of the VT through the Korea Strait during this period is partitioned 33 %, 23 % and 44 % for seasonal, interannual and intraseasonal time scales respectively. Partition for the Tsugaru Strait is 59 %, 16 % and 25 % for the same temporal scales. Forcing for these temporal variation is under investigation by examining statistical relations between transports and various atmospheric and oceanic parameters.

P-64

Argo for long-term ocean variability and climate research

Kuh Kim, Jong Jin Park
School of Earth and Environmental Sciences, Seoul National University

Argo is a global array of 3,000 free-drifting profiling floats that measures the temperature and salinity of the upper 2000 m of the ocean. This allows, for the first time, continuous monitoring of the temperature, salinity, and velocity of the upper ocean, with all data being relayed and made publicly available within hours after collection.

We are increasingly concerned about global change and its regional impacts. Sea level is rising at an accelerating rate of 3 mm/year, Arctic sea ice cover is shrinking and high latitude areas are warming rapidly. Extreme weather events cause loss of life and enormous burdens on the insurance industry. Globally, 8 of the 10 warmest years since 1860, when instrumental records began, were in the past decade. These effects are caused by a mixture of long-term climate change and natural variability. Their impacts are in some cases beneficial (lengthened growing seasons, opening of Arctic shipping routes) and in others adverse (increased coastal flooding, severe droughts, more extreme and frequent heat waves and weather events such as severe tropical cyclones).

Understanding (and eventually predicting) changes in both the atmosphere and ocean are needed to guide international actions, to optimize governments' policies and to shape industrial strategies. To make those predictions we need improved models of climate and of the entire earth system (including socio-economic factors). Lack of sustained observations of the atmosphere, oceans and land have hindered the development and validation of climate models. An example comes from a recent analysis which concluded that the currents transporting heat northwards in the Atlantic and influencing western European climate had weakened by 30% in the past decade. This result had to be based on just five research measurements spread over 40 years. Was this change part of a trend that might lead to a major change in the Atlantic circulation, or due to natural variability that will reverse in the future, or is it an artifact of the limited observations? In 1999, to combat this lack of data, an innovative step was taken by scientists to greatly improve the collection of observations inside the ocean through increased sampling of old and new quantities and increased coverage in terms of time and area. (from www.argo.ucsd.edu)

P-65

Issues and opportunities in sustainable management of water through the community based organizations in South Asian Countries - A case study in Sri Lanka -

Kandula Pathma Kumara
Faculty of Agriculture, Dept. of Agricultural Engineering, University of Peradeniya

In developing countries there are lots of problems in managing the water supply schemes. The Community based organization (CBO) has came into consideration as a solution for problems. But there are enough experiences for identifying issues and opportunities that can be used as a lesion to have sustainable water management schemes in the region. This study was based on the evaluation on the CBO's.

Hokkaido University International Symposium on Sustainable Development

Organizing Committee

Chairperson	Mutsuo Nakamura	President, Hokkaido University
Co-Chairperson	Takeshi Kishinami	Executive and Vice President, Hokkaido University
Committee Members	Hiroshi Saeki	Executive and Vice President, Hokkaido University
	Yoshihito Osada	Executive and Vice President, Hokkaido University
	Masaaki Hemmi	Executive and Vice President, Hokkaido University
	Tadayuki Hayashi	Executive and Vice President, Hokkaido University
	Kenichi Iyama	Executive, Hokkaido University
	Hajime Endoh	Executive and Director General, Hokkaido University

Program Committee

Chairperson	Takeo Hondoh	Professor, Institute of Low Temperature, Hokkaido University Global Manager, Hokkaido University Initiative for Sustainable Development
Committee Members	Motoyoshi Ikeda	Professor, Faculty of Environmental Earth Science, Hokkaido University (HUISD)
	Hiroshi Kida	Director, Research Center for Zoonosis Control, Hokkaido University Professor, Graduate School of Veterinary Medicine, Hokkaido University
	Mamoru Kobayakawa	Professsor, Graduate School of International Media and Communication, Hokkaido University
	Mitsuru Osaki	Director, Sustainability Governance Project (SGP), Hokkaido University Professor, Research Faculty of Agriculture, Hokkaido University
	Yoshimasa Watanabe	Professor, Graduate School of Engineering, Hokkaido University
	Fumikazu Yoshida	Professor, Graduate School of Public Policy, Hokkaido University

Secretariat Office

Hokkaido University International Symposium on Sustainable Development

Hokkaido University Initiative for Sustainable Development (HUISD)

International Affairs Division, Hokkaido University

Kita 8, Nishi 5, Kitaku, Sapporo 060-0808

Tel +81-(0)11-706-2093 Fax +81-(0)11-706-2095

E-mail: kouryu@general.hokudai.ac.jp

http://www.hokudai.ac.jp/huisd/

作成日：平成 29 年 3 月
作成者：北海道大学サステナビリティ・ウィーク事務局
〒060-0815 北海道札幌市北区北 15 条西 8 丁目
TEL　011-706-8031／ E メール contact@oia.hokudai.ac.jp
北海道大学国際部国際企画課
〒060-0815 北海道札幌市北区北 15 条西 8 丁目
E メール planning@oia.hokudai.ac.jp