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Climate and Ecosystems Change Adaptation Research

Higher Education for Climate and Ecosystems Change

Adaptation Asia

Working with Local Communities

Proceedings of the 3rd UN-CECAR Conference and Workshop held in Yogyakarta, Indonesia, 8-10 March 2010

UNITED NATIONS UNIVERSITY
UNU-ISP

IR3S
Integrated Research System for Sustainability Science

International Conference and Workshop on

The Role of Higher Education in Adapting to Climate and Ecosystems Change

WORKING WITH COMMUNITIES

Organized by UNU-ISP, UGM and IR3S

Yogyakarta, Indonesia, 8-10 March 2010

Edited by
Srikantha Herath
Alva Lim
Shimako Takahashi

Institute for Sustainability and Peace
The United Nations University
53-70, Jingumae 5-chome, Shibuya-ku
Tokyo 150-8925
Japan

Tel: (03) 5467-1212
Email mbox@hq.unu.edu

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PREFACE

The 3rd international conference and workshop on the Role of Higher Education in Adapting to Climate and Ecosystems Change: Asia was held during 8-10 March 2010 and hosted by Universitas Gadjah Mada, Yogyakarta, Indonesia. This event is part of a conference series for the University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR).

UN-CECAR is an institutional platform for universities across Asia and Africa to strengthen education and research on adaptation to climate change and ecosystems change, and to build the emerging sustainability science discipline. The Networks' goal is to reduce vulnerability to climate and ecosystems change. To reach this goal, UN-CECAR's key objectives are to

1. Build a community of specialists and practitioners on climate and ecosystems change adaptation
2. Develop a platform for communication, resource sharing and knowledge accumulation; and
3. Strengthen higher education institutions in the region

The 3 Pillars of UN-CECAR's work are centered on developing:

1. Educational programs (curriculum development)
2. Joint and collaborative research
3. Policy support and outreach

The Network was established in June 2009 by the United Nations University Institute for Sustainability and Peace (UNU-ISP) with the support of the Integrated Research System for Sustainability Science (IR3S) of the University of Tokyo. Within its first year, the Network has expanded to include 30 universities as part of its International Coordinating Committee (20 in Asia, and 10 in Africa). The conference series draws on the shared experiences of its university members and various stakeholders from other organizations and research institutes.

The UN-CECAR framework aim to address pressing global problems through sustainable localized solutions developed with local communities through participatory research programs. In this context the key theme of this event was selected as "university-community partnerships in adapting to climate change and variability". The University of Gadjah Mada, Yogyakarta, Indonesia, is well qualified to host this program with their extensive experience in community based research development and implementation as part of the university's post graduate programmes. Their activities were highlighted with a mini expo exhibition of ongoing community based adaptation programmes and a one day field visit to some of the demonstration projects.

In addition to taking stock of UN-CECAR's progress up to date, the event also comprised of a one day international conference to disseminate latest information and challenges related climate change and adaptation.

The third day was dedicated to deliberations of University network experts on developing educational and research programs for climate and eco-system change adaptation research in the Asia Pacific Region. The workshop is to support the implementation of the activities of the UN-CECAR network supported by the IR3S initiative as well as regional research programs such as 'Impacts of Adaptation to Climate Change' supported by the Mitsui Foundation.

We are very much thankful to the support of Integrated Research Systems for Sustainability Science for supporting this workshop, Ms. Sidat Atapattu for typesetting the document and Mr. Hideyuki Konishi for the cover design and layout help.

Srikantha Herath
Alva Lim
Shimako Takahashi

Institute for Sustainability and Peace
United Nations University

1 EXECUTIVE SUMMARY

IMPACT OF CLIMATE CHANGE IN INDONESIA

Indonesia is a maritime country with 17,508 islands scattered at the equator between two large oceans, the Pacific and Indian Ocean. Indonesia's tropical climate is home to a fantastic biodiversity of flora, fauna and micro-organisms. Its rich rainforests (120 million hectares) also serve as lungs of the world. Indonesia is also located in a mega-disaster area. It frequently experiences unpredictable and excessive rains, floods, landslides, earthquakes, crop pests and diseases and sea level rises. Under climate change where the intensity, frequency or variability of environmental disasters is likely to rise, Indonesia's rich ecosystems stand to lose a great deal. This is a serious issue when three quarters of the population depend heavily on two climate-sensitive sectors: agriculture and fishery. Indonesia's vast 250 million population size and the geographic distribution of its people also place the country at increased vulnerability to climate change and other human-induced risks. More than half of the population (59%) live on Java – an island only 7% of Indonesia's total land area. Educating people about climate and ecosystems change and getting their cooperation to act to mitigate and adapt, will be a critical first step.

8 MARCH 2010 CONFERENCE

The 3-day UN–CECAR conference is a joint activity of the United Nations University and Gadjah Mada University, Indonesia supported by the Integrated Research Systems for Sustainability Science initiative of the University of Tokyo. The first day was a public forum which was attended by over 150 participants, including Presidents and heads of departments from leading universities in Asia and Indonesia.

The morning session included key note speeches from the eminent Professor Emil Salim, former Indonesian Minister for the Environment, and now Member of the Advisory Council of the President of Indonesia, as well as, Prof. Dr. Fasli Jalal, Vice Minister of National Education and the Director General of Higher Education, and Dr. (HC). LR. Djoko Kirmanto, Indonesian Minister of Public Works.

Following this, there were three thematic sessions focused on:

1. The role of central government, higher education and industry in adapting to climate and ecosystems change
2. Climate change impacts and adaptation in tropical countries
3. The University Network for Climate and Ecosystems Change Research (UN-CECAR)

The first two sessions covered key sectors of priority for climate change adaptation in Indonesia (agriculture, energy, water and health), as well as the key actors (governments, communities, education institutions and businesses). The third session included presentations on climate change actions undertaken by universities from India, Malaysia, and Vietnam.

The final session for the day was the Interface Session, which presented the latest research and capacity development initiatives by developed countries, aimed at building climate change education domestically and internationally. Presentations were given by research institutes based in Japan, such as the United Nations University Institute for Sustainability and Peace (UNU-ISP), Ibaraki University and the University of Tokyo.

University-Community engagement for climate and ecosystems change in Indonesia

As part of the UN-CECAR conference series, each member of the International Coordinating Committee is invited to host an event focusing on a particular theme. The 3rd conference and workshop was hosted by the Faculty of Engineering of Gadjah Mada University (UGM) with a special focus on university-community engagement in adapting to climate change as the topic for discussion. A key strength of UGM is their considerable emphasis on community outreach and student-community empowerment through learning. UGM strongly believes that for society to take the necessary actions to adapt to climate and ecosystems change, they must have an understanding of the impacts and opportunities. Many do not know or would not have heard about climate change. In this regard, knowledge transfer across local communities and common people is necessary for effective adaptation. Established in 1951, the objective of the program *Student Community Service-Community Empowerment Learning (SCS-CEL)* is to increase empathy and solidarity of students towards the poor and the weak. As a required curricular activity, all final year UGM students are deployed to various communities where they will be stationed for many months to learn from the local community on the problems they face. Students work as a team with the community to develop strategies and solutions to those problems, whether it is related to environmental issues, energy, or food security for example. Every year, more than 100 themes/topics involving 7000 students are implemented throughout Indonesia under the program. Some examples include, environmental conservation for rural areas, water harvesting in dry remote areas using solar cell energy, micro-hydropower for remote communities, village energy self-sufficiency through biomass and biogas.

A mini-expo of various SCS-CEL projects was a feature of the conference. It provided an excellent opportunity for students to share their work to international participants, and demonstrates how the program can be used as a model for other universities to accelerate knowledge transfer in their country.

On 9 March 2010, participants were invited to visit two SCS-CEL demonstration projects: Reforestation and Rehabilitation of Wanagama Forest (Yogyakarta), and Water Supply powered by solar cells: Village Giri Cahyo (Purwodari, Gunung Kidul, Yogyakarta).

Wanagama forest work field, Gunung Kidul, Yogyakarta

Wanagama is a forest work field, approx. 600 ha of which belongs to UGM. It is located about 36km from UGM and was established in 1966. Before the involvement of researchers and students from UGM, this area was an environmentally fragile area characterized with rough topography, low-carrying capacity, lack of off-farm job opportunities, and suffered from deforestation and soil degradation.

Water harvesting for dry remote area through utilization of renewable energy (solar cells)

Around 200 of UGM's students from various disciplines were involved in the exploration of an underground river (about 100m from the surface) near Giri Cahyo village. The work started in 2006 and was completed in 2008. The project exemplifies a successful case study of a community-based water supply management and system, as it not only provides water to each household especially during dry seasons, but also because the local community manages the water supply entirely by themselves.

10 March 2010 workshop

The workshop was attended by 30 invited participants from the UN-CECAR international coordinating committee, senior faculty from various departments and faculties across UGM, and other international observers. The workshop began with a brief presentation of climate change research and activities presently being conducted at the Asian Institute of Technology (AIT) and member of the ICC, by Prof. Sudip Rakshit, Vice-President of AIT.

An introduction of the day's program and key points for discussion was given by Prof. Srikantha Herath, UNU-ISP, Senior Academic Programme Officer. Prof. Herath gave an overview of the Network's activities to date: the 4-Country Needs Assessment Reports, curricula proposals, and joint research development proposals.

Needs assessment

The overall objective of the Needs Assessments is to map the 'real' need for enhancing climate change (and related) courses or degree programs in selected countries through surveys and consultative workshops and meetings with various stakeholders. A key strategy of the needs assessment was to focus on the suppliers of climate knowledge and the sectors who would demand such knowledge.

The Needs Assessments were initiated based on the outcomes of the 2nd workshop in Ha Long Bay. It was agreed that, an assessment of higher education needs across 4 countries: China, Nepal, Sri Lanka and Malaysia, would be conducted on a pilot basis. The four countries were chosen in order to cover the full range of geographic, topographic, climatic and social diversity that exists in the Asia-Pacific region. The following is a brief summary of the interim reports from Nepal and Malaysia. China and Sriï¿½Lanka are still in the process of conducting their assessments.

Supply of climate knowledge

One common finding from all 4 countries was that many higher education institutions have existing programs related to climate change. However, they tended to focus on some aspects of climate and ecosytems change and not others. For example, in Malaysian public universities, programs tended to cluster on (1) climate science, (2) ecology/ecosystems, (3) environmental studies, and (4) earth system science. Most offer either one or two of the four clusters, several focus heavily on the physical sciences (that is, a combination of the three: climate science, earth system science and environmental studies), but few offer all four. For Nepal, existing Masters Courses include: renewable energy, water, environmental engineering, urban planning, disaster management, agriculture, forestry and public health.

The interim reports confirmed the need for adequate programs on climate and ecosystems change for increasing the adaptive capacity of each country by producing more skilled graduates and trained or experienced professionals and specialists. Greater coordination, international collaboration and resources were identified as critical for bringing existing programs to a higher quality. At a fundamental level, one of the challenges will be how to increase awareness on the understanding of what is climate and ecosystems change, its impacts and the potential for economy-wide consequences. Lack of understanding is a major reason why many, especially in the private sector, consider climate and ecosystems change as an issue only for the resource sector for example; and as such are not likely to demand climate change specialists. Adaptation strategies require whole-of-system approaches where the physical, environmental, social, urban, industrial and economic disciplines all collaborate. Lack of understanding will only continue to prohibit such collaboration.

Demand for climate knowladge

The government sector was identified as having the greatest demand for climate change knowledge and specialists. Particularly in China, a substantial proportion of climate change-related programs and research in universities are funded by the Ministry of Science and Technology (MOST). The Malaysian report was able to identify the two most desired

courses in their country according to views by government ministries and agencies as:

1. Environmental impact and risk assessments
2. Environmental change and current issues.

These are only interim results however and the scope of the assessments is still limited. There was agreement that a more broad-based needs assessment for all agencies and private sector would need to be carried out further. Also, as the surveys were drafted separately by each country, the questions and their subsequent responses, varied. The next challenge will be to synthesize the surveys, and also determine whether to further target the surveys by dividing it into two categories: one for the education sector and the other for the non-education sector.

Outcome

Final interim reports to be collected and statistical data provided. Surveys from each country to be synthesized; the synthesized survey to be then distributed to other members who are invited to use it to conduct a needs Assessment for their country.

CURRICULUM DEVELOPMENT

At the 2nd UN-CECAR workshop in Ha Long Bay (23-24 August 2009), the network agreed to establish a curriculum development taskforce consisting of 3 teams. The teams would be responsible for the following themes:

1. Science of Climate Change
   (Lead by Australian National University)
2. Impacts and Vulnerabilities
   (Lead by Vietnam National University)
3. Adaptation and Mitigation
   (Lead by Universitas Gadjah Mada)

Each team is to come up with two detailed course outlines each containing various modules. The modules will be categorized as:

1. Core
2. Specialized themes and
3. Cross cutting with other disciplines.

In total:

- 2 courses per theme = 6 courses
- 3 categories per course = 18 course outlines

	Core	Specialized	Cross-cutting	Total
Science of Climate Change	2	2	2	6
Impacts and Vulnerability	2	2	2	6
Adaptation and Mitigation	2	2	2	6
Total	6	6	6	18 course outlines

At the Yogyakarta workshop, each team gave a presentation of some of their proposed modules. The modules were designed in partnership with their academic staff, with each university utilizing their institutional strengths. For example, in the case of Universitas Gadjah Mada, community-based modules were a key feature of their course design.

Outcome

At the conclusion of the Yogyakarta workshop, it was agreed that, as a first step, the three taskforce teams will design two full course outlines. These two courses will be tested in September 2010, where up to 24 nominated Masters Students will be invited to UNU Tokyo for 3 weeks to take the courses as a trial run. The trial two courses can be composed of different modules from the original 18 outlines. After the trial run, students will be asked to evaluate the courses, and the feedback will be incorporated into the re-design and improvement of the curricula.

JOINT RESEARCH DEVELOPMENT

It was agreed in August 2009 that the two areas of joint/collaborative research development would be:

1. Extreme events or sudden onset disasters related to climate change; and
2. Disasters associated with long term or slow change impacts from climate change.

A two-team taskforce was established to take responsibility over the development of each theme. Furthermore, the research should focus on: 1) phenomena and/or physical characteristics; 2) impacts on landscapes and ecosystems; 3) mitigation measures in the context of climate change adaptation.

During the workshop, Prof. Tabios from the University of the Philippines presented the action plan of the task group. Prof. Li from the Chinese Academy of Forestry then presented in detail, a proposal for a collaborative research project in the area of land-degradation (as an example of a slow-onset disaster) with 4 possible test sites in China.

Outcome:

1. designate key institutes to prepare capsule (module) proposals for each topics listed above in which a research project template will be provided to make the proposals;
2. define research priorities and agenda for UN-CECAR; and
3. develop research modules.

PARTICIPATING UNIVERSITIES

1. Faculty of Engineering, Universitas Gadjah Mada, Indonesia (host)
2. Climate Change Institute, Australian National University, Australia
3. Department of Civil Engineering, Bangladesh University of Engineering and Technology, Bangladesh
4. Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry, China
5. Institute of Hydrology and Water Resources, Tsinghua University, China
6. Center for Atmospheric Science, Indian Institute of Technology, Delhi, India
7. Yeungnam University, Korea
8. Institute for Environment and Development (LESTARI), Universiti Kebangsaan, Malaysia
9. Department of Civil Engineering, Institute of Engineering, Nepal
10. National Hydraulic Research Center, University of the Philippines
11. University of Peradeniya, Sri Lanka
12. Asian Institute of Technology, Thailand
13. Faculty of Engineering, Chulalongkorn University, Thailand (new member)
14. National University of Viet Nam, Viet Nam
15. Institute for Global Change Adaptation Science, Ibaraki University, Japan
16. Department of Civil Engineering, University of Tokyo, Japan
17. IR3S, University of Tokyo, Japan
18. Institute of Sustainability and Peace, United Nations University, Tokyo, Japan (Secretariat)

Part I

UNIVERSITY-COMMUNITY ENGAGEMENT

2

STUDENT COMMUNITY SERVICE-COMMUNITY EMPOWERMENT LEARNING (SCS-CEL): INCORPORATING UGM EXPERIENCE TO CECAR FRAMEWORK

INTRODUCTION

Development that is inclusive and sustainable is one of the greatest challenges we have today. While advances of science and technology has made tremendous progress, the benefits have not reached all equally. We need to explore new ways of ensuring development and progress reaches all parts of the world in rapid and replicable ways.

On the other hand the 21st century has shown us the fragility of the global environment and the need to share responsibility to preserve global environment while addressing development challenges. Climate change and its potential to disrupt global economy, lifestyles and livelihoods has become a pressing issue of utmost importance. Especially vulnerable are the groups who depend on ecosystem services for their daily livelihoods. Climate change has the potential to disrupt these services in quantity, in intensity and timing. In response to these challenges, a strong international consensus has emerged on accepting the need to adapt to climate change and to support those who need to adapt.

The global climate is a outcome of a myriad of processes that constitute global energy and water cycles.The future climate of a particular location, therefore is a result of human interaction with nature throughout the world and may have very little to do with the actions and practices of that particular location. Similarly, as the climate is the resultant of dynamic interaction between the global energy and water cycles and human activities, all local actions play a role in the future of the global environment. The degree of influence of these activities, however, at global scale vary widely. For example, with GHG emissions from developed countries are mainly responsible for the current global warming trends, while the majority of developing nations who are affected most have very little contribution to the GHG output. In order to address this issue in an equitable manner, the global community have come to accept the principle of Common but Differentiated Responsibility to preserve global environment and promote sustainable development. The developing countries thus need to need to pay much attention to adapt to the changes taking place globally but at the same time have a responsibility to take care of the environment too.

UN-CECAR aims to support this two way process by connecting the global needs and concerns with the adaptation needs and development aspirations of communities. In order to assess adaptation needs, it is necessary to understand the future of the climate and its impacts at local

scale. Future climate needs to be derived from global climate projections and downscaled to local scale so that impacts can be assessed. The impacts resulting from these global climatic variations are heavily influenced by local bio-physical characteristics and the lifestyle of communities. Therefore, adaptation is a local phenomena and sound strategies must be designed and evolved at the local level. It is also important to incorporate generations of already-accumulated wisdom of local communities and their collective experience in such design. In this regard, education must play the important role of connecting local wisdom to global knowledge and find ways for sustainable fusion of the two segments of knowledge. Higher education sector has the resources and the opportunity for this and working closely with local communities is critical for the success of process.

LESSONS FROM UNIVERSITY OF GADJAH MADAH FOR UN-CECAR

The Student Community Service-Community Empowerment Learning (SCS-CEL) program is a unique and innovative initiative by the University of Gadjah Madah (UGM), Indonesia. The program is also called Kuliah Kerja Nyata-Pembelajaran Pemberdayaan Masyarakat (KKN-PPM) in Bahasa Indonesia. The details of the program is introduced later in this volume in the welcome remarks of Prof. Tumiran, Dean, Faculty of Engineering of UGM.

The community service program was initially introduced to the participants at the 10-12 June 2009 Tokyo conference; the event that officially launched the UN-CECAR initiative. At the second UN-CECAR conference and workshop in Vietnam, August 2009, Prof. Tumiran, Dean of the Faculty of Engineering, UGM, proposed to include the concept of the community service program into the UN-CECAR framework to ensure the linkage and potential synergies between university research and community services. The original UN-CECAR concept linked the higher education sector to the global challenges and platforms through UN and other international programs, and reached professionals through training programs and public through outreach programs such as Education for Sustainable Development. The community services program of designing and implementing adaptation programs provide a unique opportunity to rapidly deploy global knowledge and raise awareness to adapt to climate change. At the same time, UN-CECAR can link and enhance the community actions in preserving environment to global sustainability through global adaptation programs. The 3rd UN-CECAR conference is held in Yogyakarta to provide a strong foundation for this interaction.

Challenges

In the process of the program's implementation and evolution, it has been reported that there have been many challenges for the university

academic staff. First, research outputs and activities do not necessarily match with community needs at all times, due to several factors;

1. University research outputs are not directly linked with the community needs, particularly when research programs are designed only based on academic perspectives and objectives which do not necessarily match with local needs.

2. It is not uncommon for many university researchers to remain unfamiliar about community issues and needs, particularly if they are rarely involved in communities and their daily life.

3. University researchers tend to conduct research for academic careers, but people from local communities in developing countries do not necessarily gain services and benefits from such research.

These are issues that the higher education in developing countries should address.

As the program evolves to improve students' education and research development, focussing on bringing benefits to communities in a sustainable manner, it can be expected that governments and industry will continue to enhance support for the program. As project outputs and community-based best practices are disseminated, there is high potential for innovative research and planning to emerge and spread across the country, from the students to the local and regional levels. It has been seen in the past that synergies and stimulus arising from multi-disciplinary teams have helped produce creative topics for further research. Processes must be set in place to make use of communities' response and feedback in a systematic manner for improving the effectiveness of community-oriented research.

CASE STUDIES FROM UGM STUDENT COMMUNITY SERVICE-COMMUNITY EMPOWERMENT LEARNING PROGRAM (SCS-CEL)

Adapted from the "University-Community Engagement in Climate Change Adaptation Action for Better Life" Report produced by Universitas Gadjah Mada for the International Conference and Workshop on the Role of Higher Education in Adapting to Eco-system and Climate Change (8-10 March 2010)

This section briefly explains some of the projects initiated under the SCS-CEL program:

1. Wanagama: Piece of a Story about Reforestation
2. Renewable Energy Applications for Sustainable Development
3. Water Ditches as Micro-hydropower System in Desa
4. Natural Disaster Mitigation
5. UGM Students Develop Green Roof System for Sustainable Living
6. Coastal Area Rehabilitation
7. Water Harvesting for Dry Remote Area Through Utilization of Renewable Energy
8. Zero Waste Production System in Small/Medium Industrial Cluster as the Core of Innovative Sustainable Village
9. Waste Refinery Center
10. Towards Innovative and Sustainable Village in Dusun Kemuning
11. Environmental Sustainability in Mantren Village

Case Study 1: Wanagama: Story about Reforestation

Wanagama are covers four villages in Kecamatan Patuk and Playen, Gunung Kidul (one hour drive from Yogyakarta City).

Reforestation of critical land

Figure 2.1: Wanagama - Past

In the past, the area was characterized as infertile and barren land. The land had been considerably degraded due to illegal logging. The concern about the critically barren condition of the land moved some academics from Forestry Faculty of Gadjah Mada University to reforest the area. This marked the beginning of a big project to reforest the area with reddish-brown Mediterranean soil.

The reforestation project was pioneered by Prof. Oemi Hani'in Suseno (recipient of the Kalpataru Award – the highest award in Indonesia for

environmental issues). Using her own personal finances, the professor established the project in 1964; Wanagama was only 10 hectares in width at that time.

The persistence of Prof. Oemi and her colleagues to regenerate the land attracted many parties such as governments and environmentalists. They cooperated with the team to ensure that Wanagama became the 600 hectares of green area it is today.

Miniature Forest with various plants

Wanagama has become a habitat for more than 40 species of fauna and over 100 species of flora. It has more than 5 springs that do not dry all-year round, and provides a source of livelihood for the people living around it. Because of the dozens of planting test plots and conservation activities, the area has become a destination for education, training, and research.

To visitors touring Wanagama, the forest offers a strong sensation of 'returning back to nature'. To them, Wanagama feels like a miniature forest of what it once was, with diverse species of plant life.

Figure 2.2: Wanagama - Present

Lines of trees can be seen when exploring Wanagama, starting with acacia trees, which is produced into pulp; the prima donna of many Industrial Plant Forest companies in Indonesia. Next are eucalypti species, which is famous for its eucalyptus oil which can be used for many medicinal purposes, such as warming our bodies.

There are also pine trees (Pinus merkusii). These trees can be found in Central Sumatra, and offers great shade when the sun shines brightly.

Wanagama has many other plants such as ebony (Diospyros celebica) the black wood from Sulawesi, sandal wood (Santalum album) the fragrant wood, murbei (Morus Alba) and teak wood (Tectona grandis).

What Prince Charles left in Gunung Kidul

Wanagama has one tree that is visited by tourists worldwide. It is the teak wood tree (Tectona grandis) known as Jati Londo planted by Prince Charles when he paid a visit to Wanagama in 1989. It was told that there is a unique relationship between the famous tree and the marriage of Prince Charles and Lady Diana. When it was 1 meter high, this tree dried at the same time with the announcement of the separation of the English Royal couple. Did the teak wood mourn over the separation of the planter?

In addition to Jati Londo, Prince Charles also left a favorite route usually taken by visitors of Wanagama. The route starts from Wisma

Cendana and ends at Hell Hill. The road is 50 meters long with many sandalwood growing along both sides.

Case Study 2: Renewable Energy Applications for Sustainable Development

The eradication of extreme poverty, the pledge of enviromental sustainability and the development of global partnerships to create a better world to live in, are part of the United Nations' Millennium Development Goals. The target to accomplish these goals is the year 2015.

One of the university's community service-based projects is an initiative to integrate the sustainable development concept into real life projects. The purpose of this project is to provide sustainable power and water supplies to remote areas, especially as part of disaster response and reconstruction in Indonesia, by utilizing renewable energy sources, such as solar energy available in the particular areas. This would provide a significant improvement to the reconstruction process and thus improve the lives of the local community.

It is also probable that the addition of power and clean water supplies to these deprived rural areas will improve their living standards beyond their original conditions. The implementation of part of this project, which was initiated by two student groups from Australia and Indonesia and sponsored by UNESCO and Daimler, is presented.

The implementation was designed as part of a community service program that involves a group of students from multi-disciplinary backgrounds, and attracts participation and partnerships from the local community, local government, governmental institutions, as well as industry. In this program, groups of final year undergraduate students from various backgrounds are deployed for a period of two months into rural areas throughout Indonesia in order to be actively involved in the development process in the designated locations. At least one member of the academic staff is responsible for supervising a group of students.

In this way, students obtain first-hand experience of dealing with local community problems. They are expected to become agents of change and agents of development, together with the local community. For this project implementation, two groups of students were deployed as a continuous program: first group involving 28 students were deployed in July - August 2008 for the preparation stage, and the second group involved 26 students being deployed in July —August 2009 for the installation of a solar water-pump system. Through this community service, there are lessons to learn for all stakeholders involved in promoting sustainable development with the aim of attaining the UN Millennium Development Goals.

Case Study 3: Water Ditches as Micro-hydropower System in Desa

Desa Minggir used to be one many places heavily dependent on the government for electricity power supplies. The supply from the govern-

Figure 2.3: Microhydro power system

ment itself relies on fuel which keeps decreasing day by day. To address this dependency, the students of Master Program of Engineering System UGM initiated a project to develop an alternative energy source: micro-hydro power. The alternative solution is perceived as appropriate since Desa Minggir has available water ditches that could be used as an energy source.

By using the water ditches as the energy source, students in collaboration with the local people, were able to build a micro-hydro system. With this power system, Desa Minggir can be more independent from the national grid, by having its own power source which can provide electricity to the whole village. Furthermore, it can be developed as the alternative for bigger capacity not only in Desa Minggir, but also for other areas. In addition, it can save the use of fuel as an energy source for electricity. With the collaboration of the students of Master Program of Engineering System at UGM and the local people, Desa Minggir now has an eco-friendly, as well as locally-empowered, source of energy.

Case Study 4: Natural Disaster Mitigation

Disaster mitigation is a term used to explain every action intended to decrease the impact of a disaster before it occurs, including the readiness and long-term actions to mitigate risks. The scope is the planning and the implementation of the actions to decrease the risks related to human-induced and natural disasters, and the planning process to effectively respond to the actual disaster.

Disaster mitigation consists of three main stages: socialization, training, and relief. Socialization means giving the understanding and the information to the society regarding the danger of the disaster as well as the impact of the disaster itself. This stage can be done through the media such as leaflet, local newspaper, radio, and television.

The second stage is training which consists of indoor and outdoor training. Indoor training is about giving further information directly to the society through disaster extension, where the experts give a lecture about the disaster for example. The outdoor training focuses on the simulation of what happens when disasters occurs. The last stage is relief, which consists of aid that fulfils the needs of the victims after the disaster strikes.

One disaster mitigation project undertaken by the students of UGM was the flood in Situ Gintung Dam which was caused by the damage of the pile planking, as well as landslides in Karanganyar. In both disasters, the students acted on giving the relief, such as evacuation and also the fulfilling of the victims' daily needs.

Case Study 5: UGM Students Develop Green Roof System for Sustainable Living

The issue of climate change and lack of clean water have become major problems in urban areas. Because of urbanization and as many more people come to the cities, much more pollution is created. In dealing with these problems, an idea emerged to create a sustainable environment by providing green open space and improve urban water conservation. The Green Roof System is perceived as a proper solution in tackling these problems. The system combines the efforts of rainwater harvesting and simple domestic waste-water recycling technology with green open spaces on the tops of urban buildings. It generates green open spaces whilst reducing waste-water being disposed into the environment, wood consumption for roof material, and air pollution. It also creates opportunities in small-scale economic activity; where the potential for creating micro-enterprises can be owned and operated by the community members as their income sources.

In 2008, the Sanitary and Environmental Laboratory, Dept. of Civil and Environmental Engineering, Universitas Gadjah Mada (UGM) developed the Integrated and Sustainable Green Roof System. The project was initiated by a group of multi-disciplinary students from UGM on a full-scale building with a roof approximately 150 m^2 in size, domestic waste-water treatment plant system, solar cell system, plantation system, and a fish pond installed as biological water quality control system. The project has been one of UGM's most successful projects in terms of integrated science development and community empowerment. It was also selected by the SUEZ ENVIRONNEMENT - WATER FOR ALL Foundation as "Best Ten" in WATER FOR ALL COMPETITION and given an opportunity to compete for one of the two prizes of the competition in March 2010.

Case Study 6: Coastal Area Rehabilitation

Coastal areas are highly vulnerable to abrasion or damage to high waves. Therefore there is need to ensure the carrying capacity of coastal areas is sufficient. One solution is the arrangement and filling of the area with appropriate plants, and improving the public economy for example.

Coastal rehabilitation program conducted in 6 rural districts in Ambal, a sub-district of the Kebumen regency. This program aims to increase the carrying capacity of coastal areas in a sustainable and environmentally friendly way, while also improving the economy of

the community. Implementation of programs started in 2007, with seed exploration, production, and conservation of the nursery area of 265 ha of coastal land. Conservation and development of regional potential is still being performed until now. The main planted crop is pine trees to retain shrimp abrasion and provide a wind break.

Successful implementation of activities cannot be separated from the support of several parties, this includes among others: the Institute for Research and Community Services or LPPM of UGM, Department of Forestry, Local Government District and Sub District, Tool village, community, youth groups "Arum". LPPM of UGM is a good stimulant and funds activities for the implementation of the program. The program involves some UGM academic staff and more than 170 UGM students across 4 batches of the SCS-CEL Programs. The Program started in December 2006 and is still continuing until now.

Case Study 7: Water Harvesting for Dry Remote Area Through Utilization of Renewable Energy (Village Giri Cahyo, Purwodadi, Gunungkidul, Yogyakarta)

Water is the most important source for life. But in reality, some areas in Indonesia still experience water shortages; so much so that droughts occur frequently, especially in the dry season. It has to be admitted that fulfilling of communities' water needs remains a critical problem and has become a central source of suffering in those areas. Such drought disasters have become common for the people of Gunungkidul. The lack of surface water availability in Gunungkidul does not necessarily mean that rain never falls in the area, but that geological characteristic of karst landscapes in the area is such that the ground has many pores, greatly increasing the rate of water absorption. Efforts are needed to obtain water flow from underground water. Plawan Cave is one source of water that is never dry, even during long periods of dry season and in the wet season.

Exploration activities in the Plawan water cave was conducted using renewable energy (especially by solar cell or micro-hydropower generator) to pump out cave water. In parallel, activities to improve local community development were introduced to ensure future self-management of the system of cave water pumping after the program was completed. About 200 UGM students from various disciplines were supervised by UGM academic staff under the SCS-CEL Program to explore the underground river (about 100m from the surface). The work started in year 2006 and was completed in 2008. Nowadays, the project has been successful in providing water to each villager and to help them manage the water supply system.

Case Study 8: Zero Waste Production System in Small/Medium Industrial Cluster as the Core of Innovative Sustainable Village

Samigaluh is one of the 12 sub districts in Kulon Progo Yogyakarta, Indonesia, located on the north area of Kulon Progo. It is 700 meters

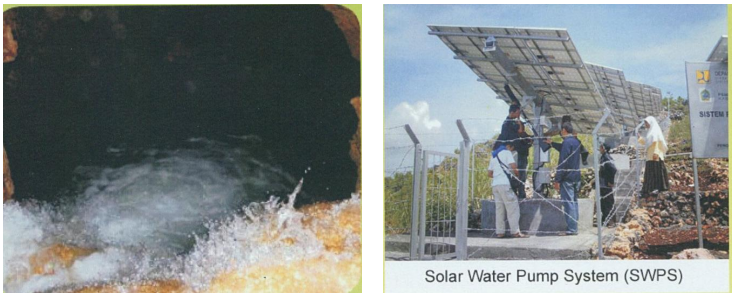

Figure 2.4: Solar powered water supply system

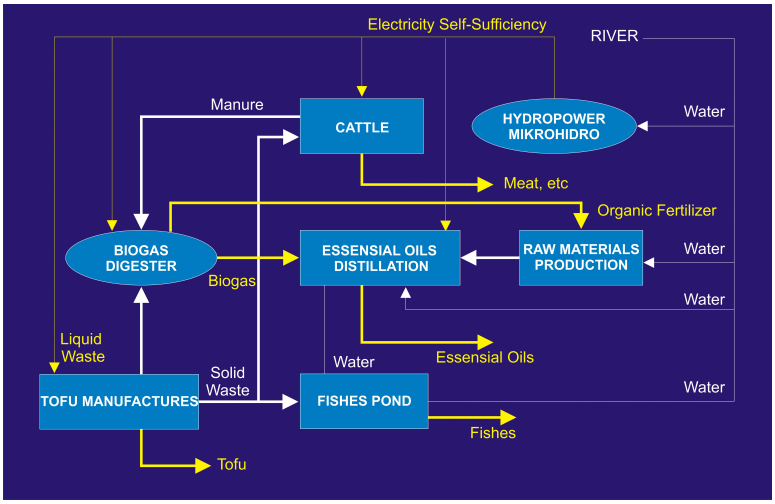

Figure 2.5: Integrated Production Systems

above sea level, has very fertile soil, and is well known for its cloves and other product such as vanilla, patchouli, tea, herbals, coconut, etc. Cloves and patchouli are used for essential oil production by several home-scale industries. One of the issues however has been the environmental problems caused by these industries; often the local government has had to remind owners about their waste problem. On the other hand, actually waste produced from essential oil industries could be integrated with other potential resources, and create side products that can increase the value of industrial activities: socially, economically and environmentally. This type of system, once established, could be defined as sustainable development system.

The idea of the project is to integrate all the potential benefits into one system, which can solve the problems faced by the Samigaluh people. The integration must also lead to a sustainable system, which is the basis for the project. The system shown below is the proposed integration process.

Besides the system itself, other important parts which cannot be separately considered, but linked to the system, are the community organizer and university. The community acts as an organizer of ev-

Figure 2.6: Interaction between parts linked to the system

ery subsystem in the system and this is essential because if there are any problems or troubles in the subsystem, the community can directly interact with the university to solve the problems. Therefore, the community is key in the sustainability of this project.

The project has been established for two years, in cooperation with The Student Community Service—Community Empowerment Learning (SCS-CEL) programs of Gadjah Mada University, involving about 30 students every year. In the first term, students focused on establishing a tofu industry as a part of the industrial cluster. In the second term, they focused on installation of biodigester and some other aspect of the industrial cluster.

Enthusiasm of people in Samigaluh about this project is very high; this is why the sustainability of this project can be expected in the future.

"Zero waste production system in small/medium industrial cluster" project has also attracted attention worldwide. This project was submitted for a Mondialogo Engineering Award, a worldwide competition held by UNESCO, and it received a gold medal as appreciation. For further development, the concept of this project will be applied in the other essential oil industry in Samigaluh, so that the environmental problems caused by the industry can be minimized to its lowest limit.

Case Study 9: Waste Refinery Center

Waste or garbage is an important issue for all. Many programs for managing waste have been done by governments, NGOs, or societies. Unfortunately, the municipal solid waste management of the public service institution in Indonesia still depends on disposal through landfills. This method has many disadvantages and has the potential to create conflict due to shortage of land, especially in urban areas. On the other hand, many parts of society have not received the service of the organized solid waste; they usually dump their garbage into rivers or streams which causes pollution and may cause flooding. Frequently they also just burn their garbage which also causes air pollution.

The paradigm of how garbage is managed should be changed. Under the sustainable development concept, garbage needs to be seen as a resource that can be converted into useful products, such as energy. In this context, the paradigm that places sole emphasis on government as the only actor responsible for garbage disposal must be changed. The responsibility of garbage management should be in the hands of all stake holders.

The Waste Refinery Center Program was initiated by the Chemical Engineering Department, Gadjah Mada University, in collaboration with the University of Boras and Boras Municipality, Sweden. This collaborative program is a combination between scientific researchers in the university with the real application in the field on solving municipal solid waste problems in Indonesia. The program systematically evaluates, develops, demonstrates and integrates some conversion techniques of waste into energy or other beneficial products.

The Waste Refinery program aims to be a scientific reference center, and to be an Interface for collaboration among stakeholders of municipal solidwaste treatment in Indonesia, so that waste can be converted into many beneficial products and/or energy.

This vision is in line with the concept followed in Indonesian Law No 18, 2008, regarding soil waste management. International collaboration with Sweden was made to obtain a good model of municipal solid waste treatment that can be easily adapted into the situation and condition of Indonesia.

Several activities in this Waste refinery program that have been done and will be continued are:

1. Visiting of Indonesian delegation (governments and universities representative) to municipal solid waste treatment facilities in Sweden.
2. Visiting of Swedish experts to Indonesia
3. Workshop on waste refinery
4. Exchange of students and staffs
5. Research collaboration
6. Development of a pilot project
7. Establishing a network on waste refinery in Indonesia

There are currently 3 PhD students, 25 master students and many undergraduate students involved in this project.

Other partners of this project are: local governments, Ministry of Environment, Ministry of Home Affairs, Ministry of National Education, and the Ministry of Foreign Affair. This program is also supported by the Swedish government through NUTEK and SIDA.

Case Study 10: Towards Innovative and Sustainable Village in Dusun Kemuning

Kemuning Village which is located in Gunung Kidul, has a relatively low rainfall, with rainfall depth about 1700 mm / year. People in Kemuning village find it difficult to access water. This is primarily caused by the soil conditions around Kemuning, which has sandy and rocky soils, making it hard for the ground around the area to hold water.

Kemuning Village is located close to Wanagama's Forest. Wanagama forest has an area of about 600 hectares which is now one of the Gunung Kidul Tourism Region and the potential to be developed sustainably. Gadjah Mada University has a community development project focused on helping the people of Kemuning Village. This community project is consists of several faculties. Some programs that are expected to be implemented are as follows.

- Improved road access to and exit from Wanagama and Kemuning village
- Provision of Alternative Energy Biogas
- Provision of rain water reservoirs
- Conduct outreach on climate change
- Guidance on increasing the resilience of agriculture
- Improved levels of nutrition and public health
- Conduct training motivation in order to transform the village to an independent economy, and to create innovation and become sustainable

One result expected from this service learning program was the realization of an independent village in various sectors, with the indicator of success being the increased standard of living of the people. People in Khave started to use alternative energy, and are now concerned about the environment and how to face global warming and climate change. With the successful implementation of these programs, Kemuning Village can be a pioneer for other villages. The development of Kemuning village will directly affect Wanagama, in order to make Wanagama one of the main tourism attractions in Yogyakarta.

Case Study 11: Environmental Sustainability on Mantren

Population growth can place increasing demands on communities, especially on food and energy supply. It will also cause proportional increases in waste, whether organic or inorganic. These issues can create a domino effect on the central government and the world, more broadly. One project under UGM's community service program is to turn cattle dung into a source of energy in Mantren Village. While many may view cattle dung as waste, it also has great potential as an energy supply, and alternative substitute for fuel wood. Waste-segregation integrated with community empowerment will be done so that waste management can run optimally. Updates on the waste management system will be carried, in an effort to create improve the environmental quality. Organic waste can be processed into organic fertilizer that can be used as a substitute for artificial (and often chemically-based) fertilizer. In doing so, Mantren village can provide their own fertilizer for agricultural use, whether in the form of wet land or for growing

household food crops in polybags at each house so that the principles of integrated farming can be implemented.

By transforming non-biodegradable waste into something more valuable under this waste management system, the final goal of food and energy independence as well as equipping villagers with a greater knowledge of the environment, can be achieved. We hope that Mantren village can be used as a model for other regions to address these issues. Support from academia and government in community development is essential.

Figure 2.7

3

EDUCATION FOR SUSTAINABLE DEVELOPMENT: LEARNING FROM THE EXPERIENCES OF THE STUDENT COMMUNITY SERVICE PROGRAM IN SMALL ISLANDS OF INDONESIA

Dr. Muhammad Baiquni
Faculty of Geography, UGM

ABSTRACT

Community service programs are learning-by-doing programs held together with communities in order to improve quality of life. This program has been developed for over 50 years in Gadjah Mada University. This paper, based on the analysis of recent experiences related to issues of sustainable development education, aims at explaining the concept of community service. To do so, three case studies have been analyzed: a tsunami recovery program in Weh island (Aceh), an environmental education program for children in Karimunjawa island (Central Java) and a research program related to managing the ecotourism world heritage site of Komodo islands (Flores NTT). This paper also explores the lessons learned as well as constraints and challenges in integrating community service programs and research based education for sustainable development, especially related to climate change.

Keyword: education for sustainable development, community service program, small islands, climate change

INTRODUCTION

Higher education in Geography as a discipline can make a significant contribution towards teaching for Sustainable Development. In developing appropriate teaching methods, a community service program is a useful learning process to help students to understand the reality of life and to experience problem solving together with communities. Community service programs can be defined as integrated efforts involving students from many disciplines to deal with certain themes in locations such as villages or small islands.

In recent higher education trends, teaching methods are developed based on advanced technology, for example, mapping by remote sensing (satellite images, aerial photography) and computer based GIS (Geographic Information System), as well as highly accurate digital laboratory tools. Besides these sophisticated methods, it is also important to develop teaching methods which are more 'high touch' i.e. learning based on values and wisdoms together with communities. High touch learning is a process of learning from experience at the grass roots level;

living in and working together with communities to solve problems and to develop skills.

With more than 50 years of experience in community service programs, it is the right time to review and renew Gadjah Mada University's (UGM) commitment to teaching for all. In doing so, this paper engages with questions such as "What do we mean by community service programs?", "What contexts and themes can we develop for community service programs?" and "What pedagogic approaches are most appropriate in teaching about environmental concerns?"

In order to answer these questions, this paper is organized as follows: firstly, a conceptual framework of community service programs is defined; secondly, methods and stages in managing the program are outlined through examples of three case studies; and finally, reflection is provided on the lessons learned.

EVOLUTION OF CONCEPT AND THEME

Community service programs were first developed by UGM, back in the early 1950s, during Indonesia's independence struggle and the post-colonial era. There was a concern among civitas academia of UGM about who should contribute in strengthening education as a golden bridge to freedom. To do so, they worked at the grass roots level to encourage children and youth to go to school. In this context, UGM set up a program mobilizing university students to serve as teachers in high schools in many remote islands outside of Java. Basic education at that time was not well established and many schools in remote areas were lacking teachers. At the time, many university students were involved in this program and became education pioneers.

Twenty years later, in 1971, the student community service program was revitalized and formalized as Kuliah Kerja Nyata (KKN). This program was updated to match with the existing challenges. In line with the politics of modernization under Indonesia's New Order Development, student community service programs were also converted to tackle issues of poverty alleviation, appropriate technology, agricultural modernization and rural development.

Today, the biggest and most pressing challenge is probably the issue of environmental degradation and global climate change. UGM should play an important role in the achievement of sustainable development by reorienting education programs, improving public awareness and providing training for related sectors. As a university unit, UGM's Institute for Research and Community Services, has the position and capacity to capitalize on the strength of education systems based on Education for Sustainable Development (ESD), in order to advance national and international competitiveness. However, there are existing gaps between research results and community service needs (Suyono, 2009).

In order to bridge the gap between research, education and community service, some efforts have been done to change our mindset towards a research-oriented university. This implies that research has

to link with education and community service. There is an opportunity for the university to have a student community service program with the following principles: a win-win solution, co-created, co-financed, flexible, sustainable and research based. Those principles should be implemented through combining an empowerment paradigm with a multidisciplinary approach.

The student community service program is a compulsory subject at UGM and works in synergy with research and education for sustainable development. By implementing the program, the community will be empowered to deal with their ESD related problems and the students will be empowered to transfer their knowledge to the community and to assist the community to be able to solve its problems, and hence the credibility of the institution will be strengthened. Synergistic activities between students and community based on ESD concepts and aims will enhance the value of the program for the students as well as the community.

The ESD themes have been adopted in the student community service program over the last five years. Under the ESD umbrella program, many students have been concerned to improve the sustainability of community welfare through poverty alleviation, illiteracy eradication and promoting public participation in development processes. The strategies to meet these aims include: policy development to effectively promote sustainable development; networking and establishing partnerships between main stakeholders (educational institutions, governments, businesses and community); and, incentive programs for sustainable development initiatives based on small and micro business enterprises. The objectives of SCS-CEL programs are as follows (Suyono, 2009):

1. Improving lecturer's capability in ESD based projects;
2. Enhancing student awareness and capability in relation to ESD;
3. Supervising, monitoring and evaluating student field activities in improving their capability and giving them experiences of ESD; and,
4. Increasing awareness and empowering the target community to solve ESD problems.

METHOD AND STAGES

The student community service program is based on principles which integrate learning by experience and involve students organizing themselves. In implementing the program, students have to follow rules such as: co-creation, co-funding, flexibility, sustainability and research based community service.

Preparation

A group of 25 students should consist of people from different disciplines able to organize themselves, to prepare a theme and to select an area of implementation. One group of students should have a mentor who is a lecturer. During the preparation of the project, the students apply some lectures related to knowledge on community development, leadership skills on managing activities, as well as technical skill to develop certain themes. The students also have to develop a proposal for the program and a set of activities based on certain themes and areas. The proposal can be a tool for fund raising and obtaining permits from local government, as well as a guidance to all students and mentors involved.

Implementation

Implementation of the student community service program is takes two months in the field. In case of implementation in remote areas and small islands, it is more expensive and takes more time. During implementation the students have to coordinate with local authorities and collaborate with the community/communities. Since the activities need resources and funds, some support is required from other institutions such as grants from donor agencies, sponsorship from the business sectors and support from local government. To get such support i.e. financial and in-kind resources, is not easy for students.

Monitoring and Evaluation

During implementation, monitoring is part of the process to follow and keep track of activities. There are some monitoring tools to be filled in and used to report to the mentor. The mentor has to give advice to the students if they have some constraints in implementing their action plan. Consultation and communication can also be done via the internet or by phone. Since the areas of implementation in remote areas and small islands lack internet access, communication is often by hand phone. At the end of implementation, every student has to make a report on their activities. A group report also has to be done after students come back to campus.

THREE CASES STUDY

Post Tsunami Recovery Program in Weh Island, Sabang, Aceh

In December 2004, a Tsunami hit hard in Aceh and North Sumatra, causing a devastating toll in human suffering and destroying thousands of buildings in coastal areas. It was a painful reminder that coastal communities are vulnerable to unexpected events that can bring about massive changes. One of the islands which suffered destruction due

Figure 3.1

to the Tsunami is Weh Island in Nanggroe Aceh Darussalam (NAD), Indonesia. It did not only have damaged infrastructure but also affected the image of Weh Island as a natural tourism destination.

Weh Island is a small island located off the northwest of Sumatra. It is known for its unique ecosystem. This ecosystem is the reason why the Indonesian government has declared 60 km^2 of its inland and sea around the island to be a wildlife protection area. It includes a large variety of fish and corals. According to Wikipedia, Weh Island is located in the Andaman Sea, where two groups of islands, the Nicobar Islands and Andaman Islands, are scattered in one line from Sumatra northwards up to the Burma plate. The island lies around 15 kilometers (10 miles) off the northernmost tip of Sumatra. Weh Island has diving spots with sea gardens ornamented by coral reefs. It is one of the 501 most popular island destinations in the world.

After disaster, Weh Island experienced damage in many sectors. One of the hardest damaged was the economic condition of its community. Weh communities that have a mix of fishermen, farmers, manufacturing workers, and tourist industry workers are likely to suffer different impacts, since each industry depends on different clients, resources, and markets.

In 2005 the Center for Tourism Studies did a rapid assessment of the impact of the tsunami to communities' livelihoods, tourism infrastructure and coral reefs. During the mission, the team also worked with communities e.g. doing psychological healing of children and sharing information on geography and environment related to tsunami. Then in the recovery period, in 2007 and 2009, student community service

programs were implemented in Weh Island. The students worked hand in hand with community by, for example:

1. Training to motivate children to learn about the environment;
2. Introducing appropriate technologies such as energy, food processing and handicrafts;
3. Improving livelihoods of the community especially related to small scale tourism services;
4. Replanting mangroves to rehabilitated muddy coastal areas;
5. Transplanting coral reefs and removing debris from the bottom of shallow water;
6. Installing mooring buoys to protect coral reefs from the anchors of ships; and,
7. Conducting public discussions and stakeholder seminar on ecotourism development.

Education for Sustainable Development Program in Karimunjawa Islands

Karimunjawa islands are situated in Central Java Province, which is one of the marine national parks in Indonesia. The marine resources in Karimunjawa are diverse not only the corals but also various fish, shrimp and others marine creatures. Such beautiful islands with seascapes and marine resources are assets for ecotourism. The development of ecotourism in Karimunjawa is believed to be able to provide socio-economic benefits as well as to help in conservation efforts. However, there are still many things in the development of tourism that need to be improved, not only related to access and attractions, but also in relation to things which are much more important to the preparation of the Karimunjawa community in managing tourism services.

The development of tourism in Karimunjawa has to consider conservation principles. For this reasons the Center for Tourism Studies has conducted basic research into tourism in this area since 2007. This research has then been continued by the community service programs which were developed by the students in 2009 and will be continued this year. Over a period of two months, a group of 25 students from many disciplines implemented various activities involving groups from the community (children, women, and youth) to work together. The students had to organize activities based on their rapid assessment of the challenges and possible work that they could undertake together with the community during two months. The program focused on environmental education, especially for children.

The above short explanation mainly tries to show that marine resources in Karimunjawa islands can be developed for ecotourism purposes rather than for the fishery industry. The tourism activity which is based on conservation of marine resources should combine with other attractions, such as history and culture which exist in the daily life

of the community in Karimunjawa. This effort would be best developed through ecotourism which hopes to improve the community's prosperity. The community does not only become the object but indeed the subject of the tourism activity. Support from, and cooperation with, various stakeholders, will become the key for the success of ecotourism developments in Karimunjawa. Thus, it is very likely that the development of tourism oriented towards ecotourism can work well in Karimunjawa (Raharjana, 2009).

Some activities conducted in Karimunjawa include:

1. Assessing ecotourism potential (nature and culture);
2. Mapping objects and facilities of ecotourism;
3. Training on conservation for the public;
4. Training to motivate youths to learn about the environment;
5. Training to encourage children to improve their understanding of subjects;
6. Strengthening groups of women to improve their skills such as food processing and culinary skills; and,
7. Conducting festivals to celebrate Independence Day including the following activities: sport, music, games, bazaar and exhibition.

MDGs, Ecotourism and Climate Change Challenge in World Heritage Komodo Islands

Tourism is believed to be able to stimulate local economies and to create job opportunities for communities. Tourism in frontier regions such as East Nusa Tenggara (Nusa Tenggara Timur) should be based on community needs and be developed in a sustainable way. Sustainable tourism consists of the triple bottom line i.e. empowering the community, strengthening the local economy and conserving nature and heritage. This concept should be implemented in the policy frameworks of the local government, as well as be present in the actions of the stakeholders.

Figure 3.2

Heritage tourism is one kind of sustainable tourism happening in sites where tourists can learn and get involved in local culture and tradition. Heritage tourism can be about the uniqueness of nature, culture or the combination of both in the unity of time and place. What distinguishes heritage tourism from ordinary nature-based or culture-based tourism is that heritage tourism objects qualify as heritage sites according to the definition published by the Convention Concerning the

Protection of the World Cultural and Natural Heritage (1972). Heritage tourism objects have extraordinary uniqueness or are defined as human or naturally made masterpieces.

East Nusa Tenggara, which consists of hundreds of islands, is a province that is associated with backwardness and poverty but owns rich natural and cultural resources. It has potential to be developed as a major tourism destination. Komodo as an icon of East Nusa Tenggara has made this province famous. But Komodo is not the only attraction of East Nusa Tenggara: there are other unexplored natural-cultural pieces of heritage that can be potential tools to achieve social prosperity through community-based heritage tourism.

Recently UGM conducted some research related to MDGs (Millennium Development Goals) at the provincial level and district level. Since this region consisting of islands has unique flora and fauna and is home to a rich diversity of cultures, ecotourism may be one of the mechanisms to help achieve MDG targets. This research recommends that education should be a one priority, among others, to develop the welfare of local people. Tourism resources in East Nusa Tenggara can be effectively developed through a couple of actions to provide competent human resources. First, establish tourism training institutes that focus on technical competency in managing small and medium enterprises in the tourism industry. Second, maximize technical competency of lecturers in local tourism institutes. Third, Government has to support educational institutes to design training models with technical competence, provide infrastructure, budget and certificates for human resources training. Fourth, there is a need to design internship programs with clear and measurable outputs i.e. levels of capability to manage tourism businesses, guide tourists, and do hospitality work for accommodation and travel business, etc.

According to the recent research in the small island of Mesa, one of the high density populated islands in Komodo area, the issue of climate change is not yet a concern of local people. Most of the heads of families work as fisherman with small wooden ships and nets. The fishing area is close to Komodo National Park. They are concerns about conservation in this park and therefore they do not enter the park water to operate their nets.

Now some research is being done into this region of Manggarai Barat, Flores. In the coming months, a group of 25 students will implement community service programs under the themes of ecotourism and MDGs (especially poverty alleviation and environmental management)

LESSONS LEARNED

1. Student community service programs are an excellent way to implement education for sustainable development. The students have opportunities to raise awareness and understand the reality of grass roots living and livelihood conditions (local concerns) as well as climate change and environmental problems (global concerns).

2. Indonesia is an archipelago consisting of thousands of islands that need strategies and best practices to mitigate disasters like earthquakes and tsunamis, climate change and environmental degradation. Some of the community services work by students in small islands can be part of efforts to mitigate disasters.

3. The diversity of culture and nature on small islands provides opportunities for ecotourism to be developed. This requires improvement in access, packaging local attractions, and management of destinations, as well as promotion and marketing strategies. Above all aspects of tourism, such as the human quality of knowledge and business skills are very important. Student community services in collaboration with professional institutions may contribute to assisting local people to improve their skill in tourism.

4. Improvements to the student community service program are needed, especially in preparing students to create innovative ideas and write these down in proposals. Proposals are tool for getting resources and funds to support student activities. They are also needed to improve synergy in implementation. UGM has to coordinate with government and collaborate with businesses in order to strengthen their support to student community service programs.

5. To support the implementation of ESD in terms of 'Tri Dharma Perguruan Tinggi' (the role of the university in education, research, and community services), faculties and research centers have to establish guidelines for ESD implementation. For this purpose, the UGM – ESD Team has established a communication forum. The team is now constructing the vision, missions, objectives, performance indicators, strategic activities, and quality assurance of the ESD program. This will be an ESD model of implementation for student community service programs in Indonesia.

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BIODATA: Dr. M. Baiquni, MA is a Geographer working in the Department of Regional Development, Faculty of Geography, Gadjah Mada University. He is also director of the Center for Tourism Studies, Gadjah Mada University. He is also a Fellow of LEAD (Leadership for Environment And Development) London. Since the mid 1980s he has been active in civil society organizations. Email address: baiquni@lead.or.id and HP 08122722102.

4

LESSONS LEARNT: CONVERTING ENVIRONMENTALLY FRAGILE AREAS INTO WANAGAMA FOREST WORK FIELD

Prof. Dr. Mohammad Na'iem M.Agr.Sc
Dean of Faculty of Forestry, UGM

ABSTRACT

Wanagama Forest is a Forest Education project managed by the Faculty of Forestry, Universitas Gadjah Mada. The total area of Wanagama is 600 ha, located in the Gunung Kidul District, 40km in the southern part of the UGM Campus. This forest has become a good example of how the power of spirit plays an important role in converting environmentally fragile barren land areas into a real forest with green vegetation, and in the transformation of poor local people into more prosperous local communities. Wanagama is a semi-arid area indicated by 1,900 mm average rain fall/year, 2-6 dry-months (<60 mm/month) and 80 day rainfall/year. This indicates the seriousness of water availability in that area, especially during dry seasons. When Wanagama started to be managed in 1964, two fundamental approaches have been applied. First, was the technical and biological approach, those have been conducted to minimize water loss. The second was a social approach; this was to empower the capacity of the local community to solve economic pressures. In line with experiences from the work field taken from Wanagama since 1976, the Faculty of Forestry has developed research collaboration with several forestry companies to implement Intensive Silviculture methods to establish prospective, healthy, and sustainable forests. This method, composed of genetically improved plant material (breeding and tree improvement), environmental manipulation and integrated pest management to increase forest productivity, been applied not only for research but also for operational purposes.

INTRODUCTION

Wanagama Forest Education is an artificial forest established in 1964 by the Faculty of Forestry, Universitas Gadjah Mada. The forest, 600 ha in size, is a representation of a semi arid area of Indonesia, located in Gunung Kidul District 40km at the southern part of Yogyakarta City. Wanagama was planned as a field work center (Yayasan Sarana Wana Jaya, 2004) which would be dedicated to:

- Finding out the pattern of forest establishment in the critical area and establishment of multi-purpose forest

- Establish the education center for students, community and field practitioners
- Preparing research facilities for the Faculty of Forestry staff to identify problems related to critical area rehabilitation
- A training center to increase the skill and knowledge for local communities, student and teachers, official governments, private sectors in the field of forest rehabilitation, forest productivity, forest establishment, forest protection and soil conservation, water and environment preservation
- A place for research results and technological transfer from Faculty of Forestry, UGM to the private and government institutions, social and non-government organizations and others.

Gunung Kidul District in the 60s era was known as a critical area. This critical condition was not only related to soil and environmental aspects, but also for the social and economic condition of the community. Up until the Dutch colonial period in the 1940's, Gunung Kidul District was dominated by a climax teak forest. However, the climate teak has been declining sharply especially since the Japanese occupation from 1942 to 1945. This condition has continued since Indonesia's Independence Day in 1945, and finally when a conflict involving the communist party happened in 1965, the teak forest really almost disappeared from Gunung Kidul, creating large numbers of critical degraded areas.

Degradation further worsened from heavy soil erosion due to its mountainous topography; also due to large rainfalls in the wet season and hot temperatures in the dry season. These factors combined have caused devastating effects, particularly in changing the soil condition from fertile to infertile forest soil. In fact, this kind of soil condition has covered large areas, especially in the eastern part of Indonesia, from east Java to Timor Island.

At that time, almost all of the people in the community worked as farmers with very limited agricultural land. Their daily needs, which include: cassava, rice, corn, peanuts, fodder for cattle, fire wood, wood for housing, have been obtained mostly from the forest area, rather than cultivated areas in their own lands. At the same time, population increase in the area so that at the time, the forest rehabilitation program in Gunung Kidul District was quite difficult to realize initially. Actually, all the mentioned phenomena created a big challenge for UGM forestry staff and students who wanted to find the way to solve the problem. In addition to this, the faculty wanted to establish a forest station where all lectures and researchers could share their thoughts and ideas, as well as turn these ideas into practical work on field. Therefore, Wanagama which was owned by the Forestry Services of Yogyakarta Special Region (with an original area size of only 10 ha) was established in 1966. In 1968, the size increased to become all of the 5 compartments, namely 79.9 ha. Finally in 1983, Wanagama was enlarged to 600 ha.

After more than 40 years, the environmental condition of Wanagama has totally changed. Almost all of the area is covered by trees; a cool

and fresh environment can been found; plenty of water springs have emerged, and many types of birds have been detected. Even though until at present Wanagama forest has still not achieved climax forest conditions yet, nevertheless, monumental efforts based on collective spirit has signified a great achievement for UGM. What we found, was that Wanagama exemplified the true spirit and struggle of dedicated forester.

In line with experiences from working on the field in Wanagama, the Faculty of Forestry has developed and implemented an Intensive Silviculture (SILIN) method. This method increases forest productivity by establishment of prospective, healthy, and sustainable forests (Soekotjo, 2009). This method is composed of genetically-improved planting material (breeding and tree improvement), environmental manipulation and integrated pest management; and has been applied only at the research scale but also at the operational scale.

THE INTENSIVE SILVICULTURE METHOD

1. Increasing forest productivity

   Increasing forest productivity through establishment of prospective healthy and sustainable forest through intensive silviculture can be done in logged-over areas (in selective cutting system) and also in timber estate plantation (in clear cutting with artificial regeneration).

   In the logged over area sustainable forest production can be ensured by following this estimation: 200 seedlings planted per ha and 30 years of rotation period, at the end of the rotation, the number or trees per ha will be 160. With diameter average of 50 cm (or 2.5 m^3/tree), and rotation period of 30 years, it is assumed that the standing stock will be 400 m^3/hectare/year, excluding residual stands between existing lines which could also be used. In timber estate (for example, teak plantation) a sustainable forest production can be ensured with the following estimation: 830 seedlings planted per ha and 20 years of rotation period. At the end of the rotation, the number of trees per ha will be 400. With diameter average of 35 cm (or 0.5 m3/tree), and rotation period of 20 years, it is assumed that the standing stock will be 200m3/hectare/year.

   By incorporating good seed sources (breeding and tree improvement), optimum land preparation, good fertilizing and maintenance (environmental manipulation), pest, disease and weed control (integrated pest management) for rotation period, the wood production per hectare at the end of rotation would increase.

2. Ensure optimum forest functions

   With increasing forest productivity,

   a) The natural forest area needed for production function would decrease, enlarging areas of natural forest for genetic con-

servation purposes. Consequently, genetic biodiversity and species diversity could be maintained. Besides the existence of conservation forests would open large opportunities for research on other forest products e.g., bioactive compounds, lipids, chemical compounds, and cosmetic elements.

b) The location of plantation could be appointed more easily, by considering aspects of accessibility, transportation and skidding distance, and topography. This will increase forest land use according to its function, such as protection forest, genetic resources, wildlife parks, and natural parks.

c) More job positions would be made available for the surrounding community, sustainability of forest management would be ensured, and company sustainability could be maintained.

TREE IMPROVEMENT PROGRAM

Tree Improvement can be defined as the application of genetic principles in silviculture to produce high quality forest products and increase the economic value of the forest. The first tree improvement work in Indonesia was carried out for teak, initiated by establishing international provenance trials on several sites in Java in 1932. However, a well planned tree improvement program was only started in 1976 by the UGM Faculty of Forestry, which established progeny trials on Pinus merkusii in three locations in Java.

Since that time, various tree improvement activities for many timber estate species have been underway in order to support the development of an industrial plantation program which was introduced in the late 1980's. At present, tree improvement activities such as exploration of genetic material, plus trees selection, establishment of genetic test plantation, hybridization, vegetative propagation, seed stand and seed orchard establishment, establishment of clonal bank and cutting multiplication garden, isozyme and DNA analysis, and genetic conservation have been conducted routinely in timber estate companies.

Pine (Pinus merkusii Jungh. Et de Vriese)

In Indonesia, Pinus merkusii has long been recognized as a good species for producing excellent wood for furniture, sawn timber, boxes, pulp and paper. It also produces high-quality oleoresin. The species is one of the few truly tropical pines in the world occurring naturally in Southeast Asia, namely Thailand, Laos, Cambodia, Indonesia and the islands of Luzon and Mindoro in the Philippines. It is unique due to its natural distribution which just crosses the equator into the southern hemisphere (Cooling 1968). In Indonesia, it grows naturally on the island of Sumatra in three disjunctive populations: Aceh, Tapanuli and Kerinci. The merkusii pine was introduced to Java in the early 1920s. Since then, it has become the second most extensively planted species

after teak in Java and Sulawesi islands covering a total area of more than 600,000 and 200,000 ha respectively. It is also grown in many other parts of Indonesia, but at a smaller scale.

A program of genetically improved stem-straightness and growth rate was initiated by UGM in cooperation with the Directorate of Reforestation and Land Rehabilitation and Perum Perhutani in 1976. There are more than 200 ha of seedling seed orchard progeny testing which have been used operationally, and which produce seeds with capacity of 2,000 kg/year. Genetic diversity of P. merkusii both for natural and artificial populations has also been elaborated using isozyme analysis (Na'iem, 2000). At the present time, a breedy strategy to produce a high-quality and quantity of oleoresin will be initiated.

Pinus merkusii has long been recognized not only as good wood producer species, but also for high quality oleoresin extract species. In general, the production of oleoresin of Pine, including Pinus merkusii is more strongly controlled by genetic rather than the growth characters. The genetic selection will be more effective for increasing oleoresin productivity, because of large size of Pinus merkusii plantation (Java, Aceh and Sulawesi populations) which are able to be objects for genetic selection activity. The breeding program for increasing productivity of oleoresin of P. merkusii began by plus trees selection. The plus trees were selected from common P. merkusii plantation in Java, Sulawesi and seedling seed orchard in Jember, Sumedang and Baturaden and infusion population of Aceh in Jember.

Based on observations during oleoresin tapping in each tree per three days activity noted the variation in oleoresin quantity was very high, ranging from 8 – 257 gram. The plus trees for oleoresin production were selected only if the plus trees have oleoresin productivity more than 75 gram per three days tapping.

More than 1000 parent trees will be selected and four series of open pollinated progeny test will be established in 3 sites: Kediri (East Java), Cimanggu, Purwokerto (Central Java) and Darmaraja, Sumedang (West Java). Every series of 250 families were tested using randomized complete block designs, 4 tree line plots with 10 replications at a spacing distance 4x4 meters. These progeny tests were converted to be seedling seed orchard after a series of rouging activities.

Establishment of P. merkusii seedling seed orchard will be more effective compared to clonal seed orchard, because beside the vegetative propagation of P. merkusii is difficult to be achieved. Pinus merkusii will produce flowers early. Establishment cost is cheap and simple but also the genetic gain achieved in each generation of Seedling Seed Orchard will be high.

Teak (Tectona grandis L.f.)

Teak (Tectona grandis L.f) is one of the most important tropical timber species due to its reputation in high quality timber. It grows naturally, though discontinuously, in deciduous forests in central and southern India, Myanmar, northern Thailand and Laos, ranging from sea level

to 800 m, and sometimes in exceptional cases, up to 1300 m above the sea level (Monteuuis, 1994). It has been introduced to many southeast Asian countries such as Indonesia (especially Java about 400-600 years ago), Sri Lanka, Vietnam and the Solomon islands.

In Indonesia, teak has been regenerated artificially not only in the area of Perum Perhutani (The State Owned Forest Company) in Java which are covering more than 1.5 million ha but also in the community forestry areas. In connection with that condition, the genetically improved planting material of teak is really needed. Teak is a species in Indonesia where tree improvement work was carried out for the first time, and was initiated by establishing international provenance trials on several sites in Java in 1932. However, since Japanese occupation and independent war periods, genetic studies were neglected until 1980s. The main objective of teak improvement program was to produce genetically improved seed through establishing both clonal and seedling seed orchards (CSOs and SSOs). Beside these orchards, in 1998, the Faculty of Forestry, in collaboration with Perum Perhutani established hedge orchards of selected clones based on clonal tests. It was established in several locations to produce good cutting materials, as fundamental resources for clonal forestry. By these vegetative materials (cuttings and plantlets), the clonal forestry in teak could be implemented. In line with the implementation of the clonal forestry program, a teak centre was launched in Cepu Forest District in 1998. Since then, all teak tree improvement activities has been managed by this centre.

FAST GROWING AND FANCY WOOD SPECIES

Since the Indonesian Government embarked on an ambitious program to develop HT1 (Industrial Plantation Forest) in the late 1980s with the aim of producing wood for pulp and paper, many fast growing species has been introduced and most are exotic species. Genetic studies in the form of provenance trials, genetic conservation and progeny tests of several fast growing and fancy wood has been conducted. The Faculty of Forestry has contributed to tree improvement programs on various fast growing species such as Acacia mangium, Eucalyptus pellita, Paraserianthes fatcataria, Gmelina arborea. The programs are conducted mainly in cooperation with forestry companies and government institutions. It is worth noting that the Faculty of Forestry has also established conservation stands at the Wanagama Education and Experimental Forest for a number of species, including teak, sandalwood (Santalum album), black ebony (Dyospiros celebica), jack fruit (Arthocarpus heterophylla), merbau (Instia bijuga).

TROPICAL RAIN FOREST SPECIES

The species under the Dipterocarpaceae family is the major economically-valued species in the tropical forests of Southeast Asia. It is distributed naturally in Kalimantan (Borneo), Sumatra, Peninsular Malaysia and

Thailand. This family is dominated by the genus of Shorea, such as S. leprosula, S. parvifolia, S. johoriensis. These are the most common light-red meranti timber, a valuable export commodity with a wood density of 300-865 kg/m^3. S. leprosula is one of the most common and most widespread emergent of lowland dipterocarp forest, ranging from southern Thailand (Patani) throughout Peninsular Malaysia, Sumatra and Borneo.

As mentioned earlier, low productivity is becoming the critical issue in the tropical rainforest. Tropical timbers from natural forest are increasingly facing heavy competition with timber from temperate forest (Freezailah, 1998). This is based upon the following:

1. The annual increment of commercial timber from natural tropical forest is only about 0.5-3.0 m^3 /ha/year compared to 4.0-10 m^3/ha/year.

2. Extraction and sustainable management costs of natural tropical forests range between US $ 50-200/m^3 compared to only US $15-30/ m^3 for temperate forests.

Based on the above mentioned facts, the development of appropriate method and strategy to overcome such problems are needed. One is to develop prospective commercial plantations of dipterocarp using intensive silviculture approaches, such as a combined genetic improvement and environmental manipulation to accelerate optimal growth and forest protection. There are several components needed to support the success of this commercial plantation, namely species selection, the use of improved genetic materials (seed or cutting) from tree improvement programs.

The first breeding work of Shorea species was started by the Faculty of Forestry in collaboration with PT. Inhutani II (a State Owned Forestry Company) in 1995 by exploring and selecting plus trees in natural forest, followed by continued progeny tests of S.pollyandra and S. johoriensis in Pulau Laut, South Kalimantan. In 1998, the Faculty of Forestry in collaboration with the Ministry of Forestry and International Tropical Timber Organization (ITTO) carried out genetic studies on Shorea species at a number of sites. Species trial plantations involving around 35 Shorea species have been established at 7 sites in Sumatra and Kalimantan. Based on the growth performance among 35 species tested, six species have been found and grouped to be fast growing Shorea, namely S. leprosula, S. parvifolia, S. johoriensis, S. macrophylla, S. platiclados and S. smithiana. These six species have been recommended for the development of commercial Shorea plantations (ITTO, 2000).

Ex-situ genetic conservations of S. leprosula from 7 populations have been established at 5 sites. These ex-situ conservation plantations are very important to maintain broader genetic basis of the species. In this period, progeny tests of S. leprosula has also been set up at 5 locations in Sumatra and Kalimantan.

A program for genetically improving the growth rate and adaptability of S. leprosula was initiated by the Faculty of Forestry, supported by the

ITTO Project, PD106/01 Rev. 1 (F). The program began by establishing progeny tests in February 2003 at a number of sites in Sumatra and Kalimantan.

Presently, shoot cutting is the vegetative propagation method applied for preparing planting stock material in operational scale through hedge orchard. Even though, producing cutting materials directly from some parent trees of valuable Shorea is still difficult (due to the mature state of the tissue), good progress has been achieved.

MODEL OF INTENSIVE ENRICHMENT PLANTING

As mentioned above, the Faculty of Forestry, supported by ITTO, and in collaboration with the Ministry of Forestry, has initiated the establishment of prospective Dipterocarp plantations in the logged-over area of natural tropical forest through intensive silviculture. The program is considered of great importance in guaranteeing the sustainability of forest productivity. The growth of Shorea sp taken from permanent plots at several locations indicated that the development of Dipterocarp plantations is economically feasible. Moreover, by improving some silviculture elements, such as the use of proper species (fast growing Shorea), fertilizer inputs good soil preparation, proper spacing and good plantation maintenance, then wood production per hectare could be increased. Assuming that the number of trees per hectare is 160 with the average stem diameter of 50cm, the wood harvested at the end of a 30 year period cutting cycle is estimated to be around 400 m^3 per ha. This does not count the remaining trees existing between line plantings. It will be much higher than wood normally harvested from natural forest, which only ranges from 40 to 60 m^3 per hectare (Soekotjo et al., 2003).

The intensive enrichment planting is designed to create the commercial Dipterocarp forests having more uniform individual trees. If does well, this model will function as the transitional silvicultural system from Selective Cutting with Artificial Regeneration to Intensive Silvicultural System. This model will also be used as a starting point in establishing the sustained and dynamic tropical forest over successive rotations.

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Part II

CONFERENCE PROCEEDINGS

5

OPENING REMARKS

Prof. Tumiran
Dean of Engineering, Universitas Gadjah Mada

At this moment we would like to extend our high appreciation to all of honorable guests, especially, Dr Joko Kirmanto, Minister of Public works, Prof Fasli Jalal, the Vice Minister of National Education, Prof Kazuhiko Takeuchi, the Vice Rector of United Nation University and Prof Sudjarwadi, the Rector of Gadjah Mada University for all their full support for this international seminar and workshop on the Role of Higher Education in Adapting to Climate and Ecosystems Change. The international seminar and workshop on the role of higher education in adapting to climate and ecosystem change in UGM, was previously initiated by UN-CECAR meeting in UNU Tokyo on June, 2009 and continued by the second meeting in Ha Long Bay, Vietnam on August 2009. At the last meeting in Vietnam, Prof. Takeuchi had decided that the next meeting will be held in Gadjah Mada University, Yogyakarta, Indonesia.

At this moment let me extend my gratitude and high appreciation to Prof Takeuchi, for trusting University of Gajah Mada to hold this event. And also to Dr Srikantha for his support and guidance in the successful organization of this program, and of course to all of my colleagues from UN-CECAR members that have given us, Engineering Faculty, Gadjah Mada University an honor to organize the event. This event will be a good opportunity for the knowledge transfer of climate and eco-systems change, adaptation and mitigation to the audience and wider community as early as possible.

At this moment I would like to inform that participants in this international conference and workshop are composed of researchers from UGM and other universities, regional government representatives, regional House of Representatives, selected master students, selected undergraduate students and foreign researchers from various universities, who will be our prominent speakers.

Recently, the researchers and experts engaged in climate and ecosystems change all over the world with various multidisciplinary backgrounds have been actively working hard to solve the problems of climate change to the eco-system. The meeting of the world nation leaders has produced a systematical international agreement in an effort to take the necessary action by every country to decrease greenhouse gas emissions which are affecting changes in the climate. It is seen as a difficult task, which may be because of the differences in technological capabilities, the economic level of developing countries, social aspects, cultural and education.

It is realized by researchers, as well as decision makers, that the climate change on earth and seal level surface is causing several problems for living creatures. Changes in the climate and ecosystem were triggered by massive human activities since thousands of years ago, and which has accumulated even up to now. Some of the impacts that can be been felt are unpredictable weather, the excessive rain that has caused floods, the changing of the sea waves, the rise of sea level potentially drowning several islands in the Pacific, as well as the melting of ice in several areas in the North Pole and Himalayan crest. All of the damages are believed to be a result of the rising surface temperature of the earth.

Climate change and the damage to the eco-system are triggered by invention of technologies by humans since a thousand years ago, and which was accelerated by industrial revolution, where the activity of humans has added immense GHGs into atmosphere such as CO_2, CO, CH_4 and NO_x. The industrial development was supported by the huge exploitation of natural resources (oil, gas and coal) and the utilization of fuel for manufacturing and transportation; households and industry are also claimed as having contributed to climate change. Technological developments and population growth have triggered large infrastructure developments, urban developments, the building of office complexes and residential development – all of which have contributed to uncontrolled forest destruction, causing the decrease of the green space and the increase of GHGs level in the atmosphere.

On the other side, people across the world are still not aware of the impact of climate change, whether they are researchers, governments or public society. This is because of differences in the point of view, opinion, and limited knowledge on the climate change, while the experts who understand about the impact of climate change seem desperate about these. That is why the effect of climate change towards the ecosystem will continuously persist if government, university, institution and individual are not taking the necessary steps to overcome this barrier.

Hence, integrated and cross-sector approaches that can be adapted by every community, needs to be developed in order to transform and transfer knowledge. All scientific communities, as well as ordinary citizens, can continue their daily life and activities while having the ability to adapt to climate change and eco-system change. The efforts are not easy however. This is more so for the developing countries. Therefore, the Institutions of Higher Education can take significant roles in the efforts to transfer knowledge to societies, so that everyone can implement it in every aspect of their life and would be able to adapt to climate change, and finally save our next generation.

We have a strong belief that ordinary people, especially those who have the ability to take necessary adaptation actions, should have proper understanding of climate change issues. Thus, knowledge transformation to the general public and communities is considered important and should be done continuously.

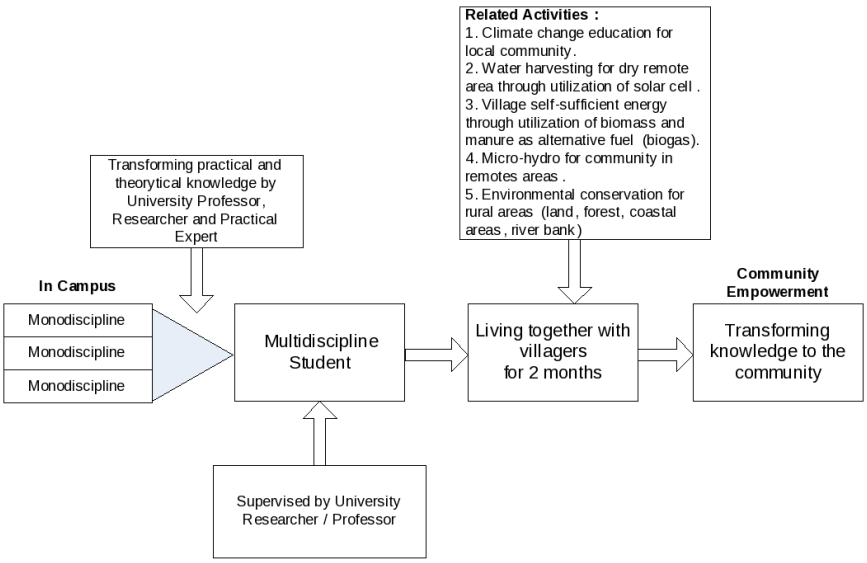


Figure 5.1: Schematic diagram of student community services activity procedure at UGM

Here, one of UGM's outreach programs called Student Community Service-Community Empowerment Learning (SCS-CEL or KKN-PPM in Dahasa, Indonesia) provides a good example that can be implemented not only in other regions in Indonesia, but also in other countries. The KKN-PPM program which involves students and academic staff has shown good results. As the knowledge and technologies which are available in the university are transferred to the community, this can result in community empowerments.

Some example of themes related to climate change adaptation in the KKP-PPM program are water harvesting for dry remote area through utilization of solar cell; village self-sufficient energy through utilization of local resources; integrated farming; zero-waste in cluster of small industries and incorporating education for sustainable development in schools and local community. This KKN-PPM program, which has been running since 1951, is not only receiving positive responses from society, but also sustainable support from local governments, industries and other stake holders. The KKN program is a compulsory subject to undergraduate students. Schematic diagram of student community services activity procedure in UGM is shown in figure 5.1. Efforts done by the Engineering faculty and UGM, not only through researchers, but also through student community services (KKN) program involving student and lecturers, has shown good results since it can urge society empowerment, transfer knowledge to the societies and implement various disciplines of science to bring about the good impact for society. Some important aspects of this program that students gain are: communication skills, adaptation and understanding of the local community, are known as key to the success of the program.

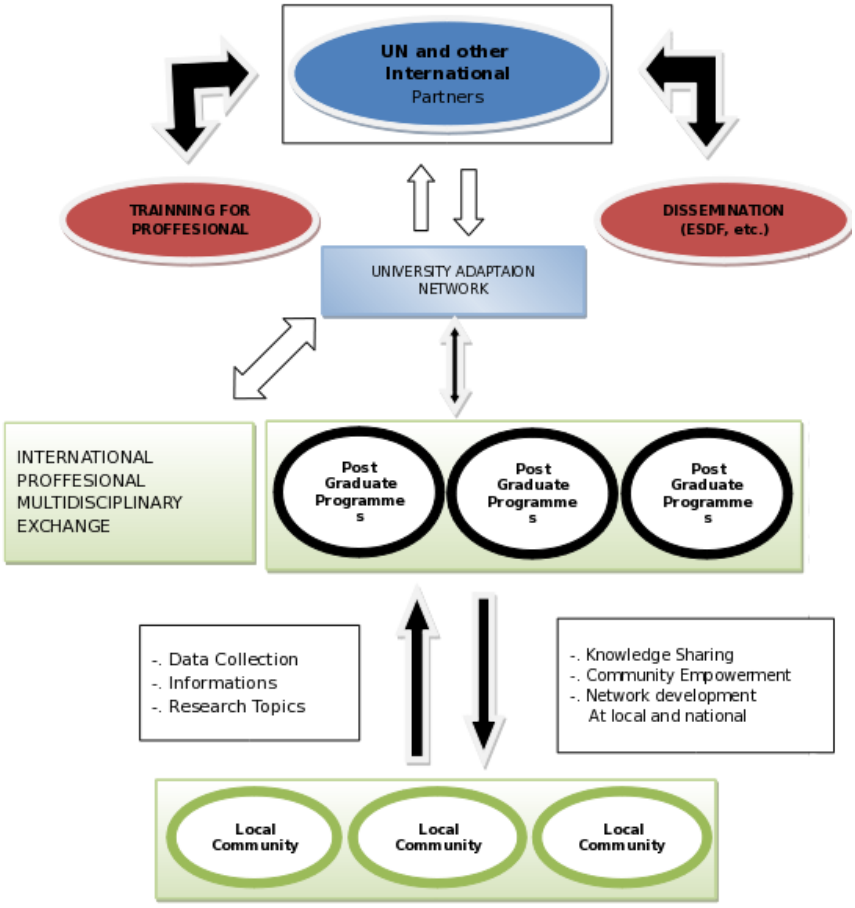


Figure 5.2: Schematic diagram of UN-CECAR incorporating student community services activity procedure at UGM

The University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR)'s international post graduate programme on adaptation to climate and ecosystem change should be highly appreciated and positively welcomed. It is because, later on, the program will be able to integrate various thinking as well as combine success stories from various nations, which can be exchanged and implemented in every nation. One of the success stories of this program will be that it gives graduates the understanding of the physical aspects that triggers climate change, the impact of climate change to the eco-system, and the potential disasters, as well as the ability to communicate with local communities optimally, including the society, governments, the scientists from different discipline and knowledge. The development concept is shown in the diagram of figure 5.2.

In the curriculum development for climate change adaptation and mitigation, the Faculty of Engineering will work together with other faculties at UGM such as Faculty of Geography, Faculty of Forestry, Faculty of Politic and Social Sciences, and Faculty of Agriculture. This

shows that the climate change issue needs a multidisciplinary approach. We hope this new international postgraduate program initiated by UNU can be established very soon as it could promote academic and research cooperation among the higher education institutions in the world, and strengthen the higher education's role in adapting to climate and ecosystem change.

Before I end my welcome speech, let me take this opportunity to welcome you to Yogyakarta, the culture city. I wish you all an inspiring discussion to change our view and knowledge.

WELCOME REMARKS

Prof. Ir. Sudjarwadi
Rector, Universitas Gadjah Mada

In this very happy occasion, first of all, allow me to express my very sincere gratitude to all of you for visiting Universitas Gadjah Mada Campus for a Conference and Workshop, on the Role of Higher Education in Adapting to Eco-system and Climate Change.

I am delighted to be here for an opportunity to welcome all of you to visit our campus Universitas Gadjah Mada that I believe for a memorable and productive conference and workshop. I expect, participants will discuss both knowledge and the promotion of the knowledge for helping the community to approach their welfare in a scenario of sustainable development, and happy life in adapting to eco-system and climate change.

Many eco-system and climate change problems that recently hit many parts of the world requires huge efforts for adaptation. Implementing a smart model for better adaptation based on co-creation of new knowledge may provide an alternative step that will be very promising.

Working in a workshop leading to co-creation in solving eco-system and climate change problems is often where constraints come. Discussion in this workshop I believe will able to identify constraints, moving from many specific experience and knowledge to more general picture of implementation, based on understanding for sustainable civilization, and human happiness in harmony with nature.

The result from this conference and workshop is expected to also result in the education and training for participants and the community as a whole. The results of this workshop may be developed as a vital component to approach solution of the existing identified challenges.

The designed education should be part of the human culture taught to current and future generations. The key word of sustainable welfare development should be arranged for HARMONY of living, human & human, human & manmade & nature, come into the process of implementation.

It is expected that a co-creation approach through this workshop will address many important aspects of the problem and its solution,. . . , related to technical, economic, social and culture to a deep extent to find basic understanding for solution of living in harmony for welfare development, for quality and human happiness.

I believe that the discussion by participants will find out the light of the art of practice in the implementation of the role of research-findings and also the related Education for solving challenges faced nowadays.

Let me remind you of some sentences spoken by the UNESCO Director General as an important document.

Persistent poverty, environmental degradation, globalization and the related economic, social and culture changes are going together along with the technological revolution. Those are facts that we are witnessing,

those are our challenges,. . . , and which UNESCO is addressing within the field of competence.

The provision of quality, lifelong education for all is clearly an absolute priority, as in the management of the world's natural resources, especially fresh water, the safeguarding for biological and cultural diversity, along with our cultural and natural heritage, and the bridging of digital (sdw: many forms) of divide (sdw: or gaps).

The general view may inspire the position of the role of this conference and workshop about eco-system and climate change problems and its solution in our world.

Further enrichment in Education on eco-system and climate change will significantly contribute to the success of a grand scenario of human welfare. This workshop may elaborate synergies in research findings through conclusion and recommendations for highlighting better adaptation to eco-system and climate change, formulating inspiration in the creation of several systems for best practices, and for implementation.

The challenge is that to produce adequate explanation of data collected through research. This has an important implication for not only the temporal but also the spatial variations of data collected in the world. The studies [of the relationship between regions, its environment and R&D] may open new frontiers of research, and cross boundaries of many disciplines of knowledge.

There are two central propositions in the thought of research. First, the long-term evolution of a phenomenon is governed by the accumulated impacts of physical and human nature. Second, the problem of interest of a system is a function of many parameters.

In this occasion we are expecting excellence in the transfer of relevant ideas, knowledge, and good practices and also encourage fruitful dialogue between participants for putting the very important role of knowledge creation as a part of a strategic solution for solving human challenges and paving the best way for Sustainable Welfare Development and Harmony of Living.

We put high expectation on the product of this Conference and Workshop.

For closing my welcome remark let me once again express my thanks to all of you who have allocated time to visit UGM to carry out a very important conference and workshop. Please enjoy your stay in Yogyakarta. We are expecting that all of you will have a good experience with UGM and like to come again to Yogyakarta as a tourism city with richness in education and culture.

WELCOME REMARKS

Prof. Kazuhiko Takeuchi
Vice-rector, United Nations University (UNU), Director, UNU-Institute for Sustainability and Peace (UNU-ISP) Deputy Executive Director, Integrated Research System for Sustainability Science (IR3s), University of Tokyo

Prof. Takeuchi began by expressing his sincere appreciation to Gadjah Mada University for hosting this excellent event. He also warmly thanked many of the distinguished guests, presenters, participants and students who attended. He spoke fondly about his period of stay in Indonesia, where he worked for many years. One of the areas which he worked on was the establishment of sustainable bioresources management system in Indonesia.

Prof. Takeuchi spoke briefly about UNU. Founded in 1975, the UNU serves as a "think-tank" for the United Nations system and its member states. Its aim is to produce and disseminate the latest research and knowledge to practitioners, and develop capacities of individuals and institutions. A key area of focus for the UNU is how to achieve and promote a better understanding of sustainability. The UNU regards the problems faced by the world today as a crisis in sustainability. Addressing the crisis will require integrated approaches that consider the global, social, and human systems that drive it. Under the new strategy of Rector Osterwalder, the UNU established the Institute for Sustainability and Peace (UNU-ISP) in 2009 with a mandate to promote research and education initiatives across the three cross-cutting themes of global change and sustainability, international development, peace and security.

As Director of UNU-ISP, he spoke about the Institute's goal to focus on enhancing higher education institutions – society's key source of skilled and educated labor. To promote this, in 2009, UNU-ISP and IR3S established the University Network for Climate and Ecosystem Change Adaptation Research (UN-CECAR) initiative, targeting universities across Asia and Africa. The Network hopes to provide an institutional bridge between local communities, academia and the United Nations, for the dissemination of scientific knowledge, development of (south-south and north-south) collaborative and multidisciplinary initiatives, and provide opportunities for postgraduate students, educators and professionals to obtain a wider understanding of relevant issues.

One key point of departure of this initiative is the holistic treatment of **climate change impacts** with **bio diversity issues** under the broad theme of global change. Climate change and bio diversity are very closely linked. For example, bio diversity provides resilience against climate change making adaptation easy and supports sustainable livelihoods. However, if holistic approaches are not taken in our quest for solutions, benefits for one sector can produce adverse impacts to another sector. For example, increased use of biofuel helps reduce GHG emissions, but large scale plantations supporting biofuels production

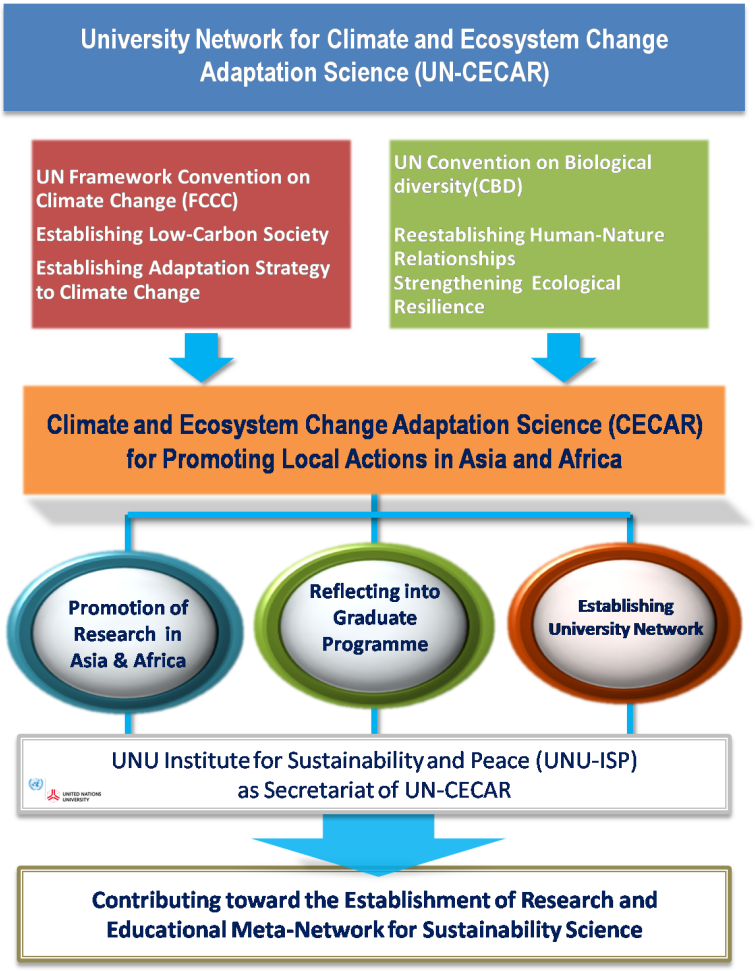


Figure 5.3: Research programme of UNU-ISP: Linking adaptation with sustainability

reduce bio diversity and the very resilience eco-systems need to respond effectively to climate change. Therefore UN-CECAR aims to address challenges from climate change as well as eco-systems change in an integrated manner. This also is a step towards seeking holistic approaches that parties adopt in addressing both UNFCC and UNCBD convention priorities.

Prof. Takeuchi expressed his confidence that UN-CECAR's timely and extremely relevant activities in addressing these two major global concerns would produce very useful results for the region. Its success is guaranteed by the commitment and enthusiasm of the network members.

6 KEYNOTE SPEECHES

FROM THE FIELD TO THE CLASSROOM

Prof. Emil Salim
Former Minister of Environment; Member, Advisory Council of the President of Indonesia

Located at the equator between the Indian and Pacific Ocean, Indonesia is the world's largest archipelago with 17,508 islands, spanning a distance of more than 3000 miles; longer then the distance "from London to Mekkah". Indonesia also has a large population of more than 240 million people located on these islands.

Indonesia suffers under climate change

Under highly uncertain and variable changes to the climate, if global temperatures rise above 2 degrees Celsius, all of Indonesia will suffer. We will experience (1) sea level rise, leading to (2) thousands of Indonesia's islands becoming under water; (3) fresh water shortages; (4) staple food crops, like irrigated rice fields will come into jeopardy; (5) floods; and (6) emerging new diseases. Yogyakarta will not be able to escape the problems also.

Mitigation & Adaptation to Climate Change

We need to raise nature's ability to absorb green-house-gases through reforestation and prevention of deforestation and land degradation. There must be a shift away from dependence on fossil fuels to low-carbon energy. People should also value the environment more; this can be done in part if we introduce more "payment for environmental services" mechanisms, but to do this we also need to correct market failures. Economic development in many countries relies heavily on market signals (price, demand and supply). But rarely does the market reflect the true costs of clean water, air and key environmental services which society depends on. This causes many market failures such as large-scale environmental damage to go unnoticed and without penalties. Producers and consumers must be encouraged to improve their resource-use efficiency while reducing their waste and pollution. For example, the amount of energy it takes to produce a wine glass in Indonesia is 6 times more than it does in Japan. In sum, what needs to happen is the complete change of mindsets and policies away from the conventional path to development to sustainable development. In the field of economics, this means we need new sustainable development economists, not the conventional economists.

Factor: Believe

Humans must live more ecologically-friendly lifestyles. But to do that humans need incentives other than the market. Policies and discussion tend to focus too much on market mechanisms or environmental regulation. We need to use other non-market incentives to encourage people appreciate, care for and value the environment. One such incentive could be through religion. In Indonesia for example, religion is a very strong driving force for guiding peoples' behaviour. There is an Islamic Boarding School in An Nuqayah which plants forests to obtain clear water needed for praying. In Islam, to be a good Muslim means to pray; to pray you need to be clean and to be clean, you need clean water. Religious reasons made the school plant trees, not environmental reasons, market rewards nor government recognition. Belief is internalized as a driving force behind more ecologically sustainable societies.

Society also needs to recognize that there are enormous development benefits from managing the environment well. An example of this is micro-hydropower in Papua, Kalimantan and Sumatra. Micro-hydropower can be critical sources of electricity for local communities. Micro-hydropower relies on the power of fast and continuously flowing rivers. Cutting the forests that surround these rivers will not only deplete river flow, but also electricity generation. The opportunity costs from cutting down trees can be enormous and may not actually be economically beneficial in the long-term.

In Bali, the people have a principle they call "Tri-Hita Karana" – it means there are three sources of welfare: God, Nature and Society. Living in harmony with all three will bring happiness and content in life. We should follow this principle, it is not only important for our health and happiness, but the health of our planet.

Pseudo-Market

Through consensus, we can create pseudo markets that place a value on environmental goods and services. Cases of pseudo markets already exist in Indonesia:

1. Water users downstream are paying upstream river people to plant trees for securing water flow by consensus; a process negotiated by NGO-Banten

2. Hotel-rooms with a view of the natural environment are charging higher rents than rooms without sceneries;

3. Sasi-custom rules not to harvest fauna-flora during predetermined time to restore nature. It is essentially a holiday for nature where people are not allowed to do anything to their natural surroundings.

We can substitute non-existing markets by creating pseudo-market through consensus.

Raising the Value-Add Of Nature

We need to increase the value add of nature, sometimes in Indonesia we do not recognizes the real benefits that can be obtained from maintaining our forests and rich biodiversity.

1. In Kalimantan, leeches are highly prized for medicinal purposes. One Dayak Chief Medang uses leeches to cure vertigo for example because they release herodin. What is odd is that while the indigenous Dayak tribes know this, some biologists, scientists in Indonesia do not. This is traditional knowledge, and we must preserve it

2. On the Brebes coast, farmers grow rice and onion using seeds that survive salted sea-water. Students of UGM can learn from the farmers of Brebes;

3. Instead of using tobacco leaves for cigarettes, some communities use the substances for medicine;

4. Squalene oil, from the heart of deep sea sharks is used as a medicinal aid to curb aging, particularly in Japan.

There are many things that nature provides; they are our biological resources (from medicines to cosmetics). Unfortunately many of us do not know, or are aware, because as we urbanize, we become more nature illiterate. The knowledge that was traditionally passed down through generations is being lost.

Changing the Development Paradigm

The economic paradigm of high and fast growth in the past can no longer apply.

1. We must change this singular linear economic development model to a triple multi-linear economic-social-ecological holistic models of development.

2. We need models that can integrate the complex interactions among networks of a.producers and consumer in the economy; b.person's interdependence with society; c.components of the ecological system; Economists must know how social systems function, social scientists must know how biological systems act, and so on. It is no longer sufficient for experts to focus only in their own area.

3. Social & ecological factors need to be internalized into the mainstream of economic development; and

4. Government intervention is necessary to correct market failures.

Interdependence in Sustainability

The triple goals of sustainable development integrate a multi-sector matrix model approach. With a common focus, each "sector experts" should identify and analyse the various inter-sector impacts (which can be revealed through calculating external costs and benefits). An optimum solution can then be derived for the most sustainable outcome from the three inter-locking networks of economy-social-ecology through dynamic systems analysis.

Challenges Towards 2050

1. Meeting the needs of 300 million Indonesians in a 9 billion populated world by 2050;
2. Doubling agriculture output without increasing the amount of land and water use;
3. Halting deforestation & raising the yield of forests;
4. Low carbon energy systems and improved demand-side energy efficiency;
5. Low carbon-based mobility/transport systems;
6. Raise resource-use productivity by 4-10 times;
7. Internalize the costs of carbon, water and eco-systems services.

Targets For 2050

According to the Vision 2050 by World Business Council for Sustainable Development, we should aim by 2050 to:

1. Meet basic needs of all, enough food/energy;
2. Have true values, costs and profits in economy – ones that reflect the real price of environmental degradation and opportunity;
3. Recovery & regeneration of forests;
4. Secure low carbon energy with true costs;
5. Close to zero net-energy buildings;
6. Access to low carbon mobility/transportation;
7. Have a four to ten-fold improvement in eco-efficiency of resources and materials from 2000 by doing more with less;
8. Create a Zero waste society;

Changing Curriculums

1. Our schools and universities must create curricula that have a "building knowledge without borders" outlook;
2. Reconsider measures of Gross Domestic Products (GDP) to include social and ecology – we should not be so fixed on only the GDP index as it does not reflect what humans truly value in life;
3. Transform "natural and social illiteracy";
4. Develop "system integration' models and methods;
5. Develop "closing the material loop";
6. Reduce ecological footprint in developing our only one earth.

As a key supplier of society's knowledge, educational institutions must not create the type of intellectuals or experts who cause the further destruction of the earth. We need people who are eco-literate and who can help us to save the world.

INDONESIA: HIGHER EDUCATION AS ROLE MODEL FOR EFSD

Prof. Fasli Jalal
Vice Minister of National Education Director General of Higher Education (DGHE)

Indonesia is geographically spread out with 17, 548 islands, 5.3 million km of sea, 80,000 km of shoreline and 155 active volcanoes. Geography of Indonesia contains ice-capped mountains to rainforests, savannah, and swampy lowlands. Indonesia cities and communities are lined with skyscrapers to shanty towns, from the old city to traditional houses, and from traditional huts to the world heritage.

Under the climate change effects, there is obvious increase of natural disasters in frequency and intensity of natural disasters in recent decades. As a large archipelago tropical country Indonesia will be badly affected by climate change unless appropriate actions (local, national, regional and international) are carried out to address climate change.

Indonesia programs and initiatives on climate change

The Indonesian government has made various commitments and established regulations that are aimed at directly addressing Indonesia's contribution to climate change. They include: cutting energy sector emissions by 17% by 2025, bold reductions in forest burning and introducing a new regulation for waste management to ban open dumps and waste.

As for Indonesia's transportation sector, the main programs and initiatives related to climate change are the "blue sky" program (Program Langit Biru); improving public transports in big cities and setting up more stringent emission standards. With regards to water, a clean river act - PROKASIH (Program Kali Bersih) was also introduced. Emission reductions, chemicals replacement, waste reduction, eco-friendly products and co-firing in CPO plants are the main programs in the industrial sector that was introduced to address climate change.

Another critical step by the government was to increase the utilization of non-fossil energy sources, such as new and renewable energy. This includes mainly geothermal energy (we have the biggest reserve in the world, equivalent to 27,000 MW), hydro-wind-solar, biofuel, gas, and coal-bed methane. Two examples are:

- Energy source conversion: In 2007 – 2008, Presidential decree to obligate household used to convert the gasoline to LPG. LPG tank is prepared by the government and subsidized.
- Energy saving: In 2007 – 2008, National State Electricity Company (PLN) : Distributed to its customer 10,000,000 tube lamps (saving lamp) to subtitute fillament lamps free of charge. The effect was a drastic reduction in the electricity generation power plant.

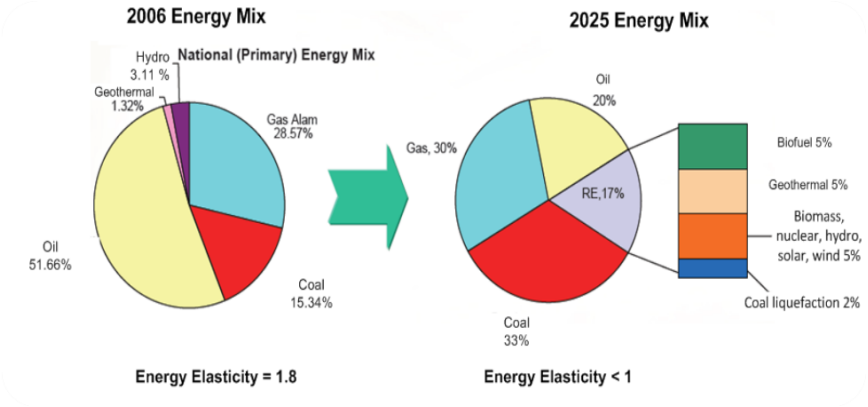


Figure 6.1: Target National Energy Mix (President Decree No.5 / 2006)

Figure 6.2: Water harvesting for dry remote area through utilization of renewable energy programme

Higher education in adapting to climate change

Higher education institutions in Indonesia have three pillars: education, research and community services. All academic staff and students have obligation to do all the three pillars.

Higher education programs in Indonesia are focused on education for sustainable development, green campus programs (funded by the DGHE), low emission campuses (e.g. by encouraging staff and students to bike to campus), synchronizing programs with local government, and community empowerment. Higher education researchers are focused on energy, food security, water conservation and global warming.

The DGHE in particular, supports institutions like regional centers of expertise such as the SEAMEO-Biotrop (Southeast Asian Regional Centre for Tropical Biology), and UGM. I should also mention that UGM hosts the UNESCO lectures series on a variety of EfSD topics: Sustainable development, Renewable energy, Disaster mitigation, etc. The DGHE is also encouraging special research clusters on climate change & bio diversity.

Gadjah Mada University (UGM) is the oldest and largest state university in Indonesia. UGM has incorporated climate change adaptation into various existing courses related to sustainability development

and climate change into both undergraduate and graduate programs, especially through: the implementation of education for sustainable developments (EfSD); emphasis on environmental issues such as by the department of civil and environmental engineering; joint courses with UNU, UH, NUS, UGM, AIT on disaster mitigation, humanitarian aids and climate change; student's final projects related environmental issues.

Climate change research in UGM covers areas such as: renewable energy from biomass waste and biofuel (supported by national and local governments, in cooperation with international agencies); hydropower, energy conversion and conservation; land reclamation and conservation; eco-product development and eco-efficiency process; sustainable infrastructure development and public transportation; sustainable water resource management (supported by the Minister of Public Works and in collaboration in with international agencies); urban planning and spatial arrangement; sustainable resources management in mining site.

Some specific examples of climate-change related programs in UGM include:

The Graduate Program in the Faculty of Engineering:

- micro hydro power system (since 2002)
- pollution prevention (since 2003)
- water resource management (2000)
- municipal solid waste treatment and management (2004, in cooperation with local government)
- disaster management (since 2002)
- Environmental, water & waste water engineering (being developed with DAAD)

Detailed Examples:

Master of Engineering System in Resource Engineering

Year	2007-now
Program	The program emphasizes on understanding natural resources potentials, its management, methods and system of utilization, and its social and environmental impact.
Competency	Graduates has profound knowledge on natural resource potentials (water, land and earth resources, mineral resources) and capability on managing and utilizing the natural resources in a systematic and sustainable way.
Period	Four semesters incl. master thesis with total length of study 24 months
Admission	Cum-laude holders fresh graduates and professionals.
International	Joint program between UGM-ITB (Indonesia) and Karlsruhe University, Germany.

Master of Engineering System in Microhydro/Renewable Energy

Year	2002-now
Program	The program emphasizes on understanding microhydro and other renewable energy potentials (e.g. wind, solar), its management, techniques and system of energy conversion, and its social and environmental impact.
Competency	Graduates has knowledge on microhydro and other renewable energy potentials and capability on managing and converting the resources in a systematic and sustainable way.
Period	Three semesters incl. master thesis with total length of study 18 months
Admission	Fresh graduates, professionals and government officers.
International	Student exchange program with Karlsruhe University, Germany.

Master program in pollution prevention

Year	2003-now
Program	The program emphasize pollution prevention rather end-pipe treatment through many ways such asusing chemicals which environmental friendly, zero emission /cleaner production, waste minimizing, recycle, etc
Competency	Students has capability to assess systematically and comprehensively environmental problems especially the ones related to process industries. Students has proper knowledge and skill in pollution prevention and industrial waste process.
Period	Three semesters incl. master thesis with total length of study 18 months
Admission	Fresh graduates and professional workers from industries
International	Student exchange program with Chalmers Univ. of Technology, Sweden

The Faculty of Geography also offers a bachelor, master and PhD program in environmental science.

The Faculty of Agriculture also has a master program in Integrated Farming

The interdisciplinary master program in infrastructure management and community development involves at least 4 faculties: Faculty of Engineering; Faculty of Social science; Faculty of Economic and Business; Faculty of Geography. It is held in cooperation with ITC, Netherlands.

Community empowerment in adapting to climate change

Some of Student Community Service-Community Empowerment Learning (SCS-CEL) program directly address climate change issues. For example: incorporating global climate change education for local community; water harvesting for dry remote area through utilization of solar cell; community empowerment related to rainfall harvesting for fulfilling community basic needs; village self-sufficient energy through utilization of biomass and manure as alternative fuel (biogas); micro-hydro community in remotes areas; environmental conservation for rural areas (land, forest, coastal areas, river bank).

Some practices of climate change adaptation in community empowerment are very successful in Indonesia, such as: water harvesting for dry remote area through utilization of renewable energy; networking development for waste refinery; micro-climate reclamation in coastal areas; networking development for infrastructure, water and environmental management; small industry ecosystem; master program of engineering system in resource engineering.

Meanwhile, some practices of climate change adaptation in education are also very successful in Indonesia. For example: masters program in infrastructure management and community development; master

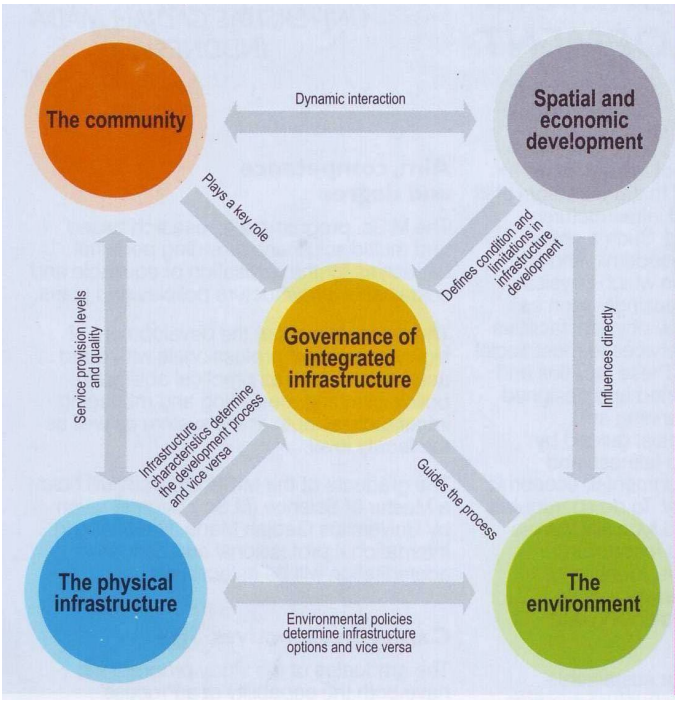


Figure 6.3: Interdisciplinary master program in infrastructure management and community development

of engineering system in micro-hydropower/renewable energy; and a master program in pollution prevention.

Case Studies of Best practices of climate change adaptation:

Case study 1: Community Empowerment

Water harvesting for dry remote area through utilization of renewable energy

Year	2006-2008
Location	Giricahyo, Sub distric Purwosari, Gunungkidul, Yogyakarta
Institutions	Faculty of Engineering UGM; The Institute for Research and Community Service; Team Waterplant Community UGM; Ministry of National Education; Local Government of Gunung Kudul; Ministry of Public Work; National Bank Association, other institutions
Student involvement	About 200 hundreds students (five period of community service programs, 2006-2008)
Output	Water availability in the dry remote area in Giricahyo village
Sustainability	Self management of water pumping system

Case Study 2: community empowerment

Micro-climate reclamation in coastal areas

Year	2005 - now
Location	Pandansimo area, Srandakan sub-district, Bantul district, Yogyakarta
Results	Micro climate reclamation for agriculture purposes
Partner	PT Indmira
Student involvement	Undergraduate students

Case Study 3: Community empowerment

Small industry ecosystem

Year	2005 - now
Location	Samigaluh, Kulon Progo District , Yogyakarta
Program	Linkage of several small industries (essential oil industries, tofu industries, fish pond) in term of cross-utilization of energy, water and waste
Result	Energy saving, waste minimization, water saving, economy impact
Student involvement	90 undergraduate students (3 period of student community service program)

Case Study 4: networking development

Waste refinery

Year	2006-now
Location	Sleman, Palu, Pontianak , Jayapura, Kulon Progo, and other cities. This program will be expanded to neighbouring countries including Thailand (in cooperation with AIT).
Partner	Local governments, Ministry of Environment, Ministry of Home Affairs, Ministry of National Education, Ministry of Foreign Affair, supported by Swedish government through NUTEK and SIDA.
Activities / Result	The establishment of network on waste refinery in Indonesia; Building demonstration plant converting waste into energy and fertilizer; Waste sorting at university; Improvement of social awareness and technical ability on waste management and conversion of waste to valuable products;
Student involvement	3 PhD students, 25 master students, many undergraduates

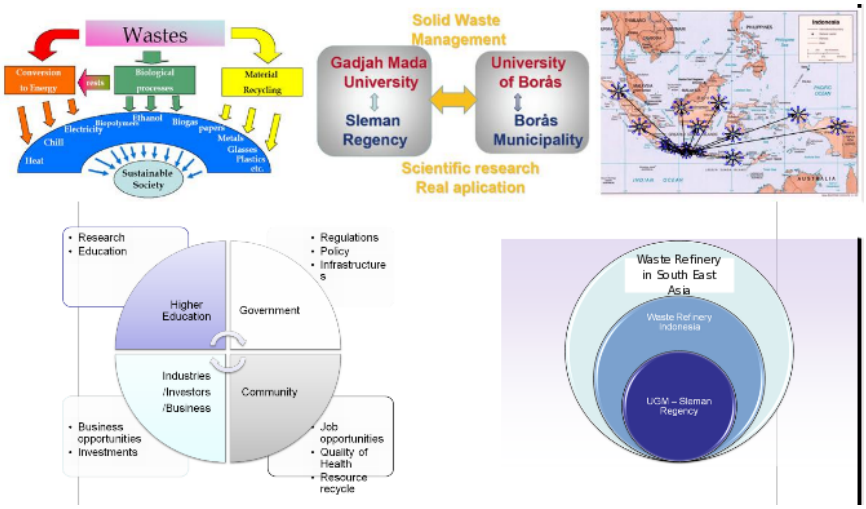


Figure 6.4: Waste refinery case study

Case Study 5: networking development

CKNET-INA: Infrastructure, Water and Environmental management

Year	2002 - now
Member	10 big universities in Indonesia including UGM (Dean of Faculty of Engineering UGM is one of the steering committee)
Vision	To become a sustainable academic and professional network to build capacity in the sectors of infrastructure, water and environment
Program	Water Resources & Irrigation Management Capacity Building Network Training demand assessment Capacity building need assessment
Affiliation	UNESCO-IHE, CapNet and AquaJaring

Conclusion

Indonesia has an important role to play in sustaining the planet. Global environmental problems need global solutions, yet have to be implemented locally. In this context, universities can act as a catalyst and pioneer in finding solutions for adapting to global environmental problems and climate change. Education for sustainable development has to be embedded in courses, and community empowerment for adapting to the climate change need to be based on research and local wisdoms. Furthermore, there is a strong need to do concrete research in order to address global issues.

CLIMATE AND ECO-SYSTEM CHANGE ADAPTATION RESPONSE

Dr(HC). Lr. Djoko Kirmanto
Dip. HE. Minister of Public Works of the Republic of Indonesia

Speech delivered by Dr. Mohammad Amron, Director General Officer & Development, Ministry of Public Works)

Problems and Challenges for the Water Sector: environmental conditions and climate change

Almost all regions of Indonesia are abundant with water resources. It receives approximately $4x10^6$ million cubic meters of water per year, with an average of 14,000 cubic meters per capita available annually. More than 80% of the present water resources are used for agriculture. The island of Java has the highest population in the country (65%), but its size is only about 7 % of the area of Indonesia, and contains approximately 4.5% of Indonesia's water potency.

More than 20 river basins in Java are facing critical water shortages. Catchment areas are experiencing degradation, which are threatening food security and rural prosperity. Degradation of environmental conditions can be clearly seen through changes in hydrological cycle (indicated by the degradation of infiltration capacity of upstream areas), reduced carrying capacity of streams, and increased saltwater intrusion and land subsidence over exploitation of river bed material. Sources of these problems largely arise from haphazard household and industrial solid waste disposal and tailings from mining activities. Addressing sources of environmental degradation will be central to addressing the impact of Global Warming and Climate Change.

Global warming will interact with many other influences

Our existing climatic problems are getting worse. When there is an El-Nino, we usually have more droughts, while under La Nina, we have more floods. From December 2009 until February 2010, 50 floods were reported in Indonesia. The El-Nino event of 1997-1998 was the most severe event experienced in 50 years. 1998 was also the hottest year in the twentieth century.

Improving our environment and adapting to climate change are urgent priorities for Indonesia. All ministries within the government and of national planning need to take environment and climate change into account in all their programmes. It is not a job only for the central government; it has to be a nationwide effort, involving local governments and communities.

Strategies to improve water resources management include: enhancing the conservation of water, optimising the water resources utilisation and minimizing the destructive potency of water. Strategies must be

aimed at ensuring the availability of water in term of spatial and temporal to meet the predicted water demands, and to lower the incidences of water related disasters.

Actions by the Ministry of Public Works (MPW)

The Ministry of Public Works (MPW) has taken the initiative to develop disaster-risk preparedness and management action plans. MPW has also recorded the incidences, status and projections on water balance for each major island. MPW have prepared a comprehensive sectoral approach on flood mitigation. In terms of drought mitigation, there are short-, mid-, and long-term programs targeted to the public works sector. These initiatives are all related with action plans developed for climate change mitigation, adaptation, and capacity development.

Further work

- Prepare and disseminate documents outlining the government's strategic framework on making water systems more robust against climate change.
- Greater innovation in water management of peat areas, not only for agricultural purposes, but also to reduce the emission of carbon dioxide from peat.

The MPW realizes that the mentioned above duties and responsibilities are not simple and easy.

Dams and Reservoirs

Dams and reservoirs may secure the spatial and temporal availability of water and generate clean and renewable generate hydro-power energy. Indonesia has a potency of about 75.07 gigawatt of hydro-power energy.

Actions

1. We must conserve and revitalize existing dams and reservoirs.
2. Improve the safety and operation of dams, by taking into account the environment and global climate change issues.
3. Increase the design standard and quality of analysis for the new dams.

These actions are aimed at increasing safety, optimizing potency and lowering human and environmental costs. Environmental conservation and adaptation to climate change will demand effective government action, which at the local government level will require much strong coordination between different sectors. These actions will lay down the

strategic principles and details of the short term, medium term and long term action plan.

Indonesia has begun to introduce national strategies for environmental conservation and adaptation to climate change. However coordinated efforts are required between different actors within and beyond the state. It depends on the cooperation between different line ministries and universities

The importance of cooperation between Universities, BMKG, Bakosurtanal, Lapan, Ministry of Agriculture, Local Governments and MPW may be demonstrated by the following simple example:

- Based on Weather Monitoring Station Data and Weather Prediction Model developed by universities, BMKG and Lapan may release prediction on Meteorological Data for the coming 3 months to the coming 3 hours. At the same time, Bakosurtanal may release the prediction on sea-water level for those periods.

- With the collected data and predictions (verified by monitoring river discharge and reservoir water level data), the Ministry of Agriculture, MPW, Local Governments and Farmers may take coordinated actions on: adjusting crop patterns; managing water levels of reservoirs; and issuing Flood or Drought Early Warning Systems. Flood or Drought Early Warning Systems are also critical for protecting our coastal-zone areas.

Emissions Reductions Target

The government of Republic of Indonesia has volunteering declared that Indonesia will reduce its carbon emissions by 26% in 2020. How we achieve this target (by what means) and how we can measure the progress will be the crucial challenge.

7

THEMATIC SESSION 1

ROLE OF CENTRAL GOVERNMENT, HIGHER EDUCATION & INDUSTRY IN ADAPTING TO CLIMATE CHANGE

Prof. Ir. Sudjarwadi
Rector, Universitas Gadjah Mada

Gadjah Mada University's experience on Role of higher education in adapting to eco-system and climate change

Gadjah Mada University (UGM) is the oldest state university in Indonesia which was established on December 19th, 1949. Meanwhile, UGM is the largest university in Indonesia, with about 50,000 students, 2300 faculty members, 18 faculties and multi-disciplines graduate schools. There are more than 200 undergraduate and graduate study programs, international students and trainees from more than 60 countries.

In order to achieve the smart utilization of resources, which include human resource and natural resource under the present environment of global climate change, knowledge related to climate change is important. Implementation for contributing to the solution of climate change problems in UGM is based on three pillars: education, research and public service.

There are various questions we need to ask in relation to the type of climate-change related knowledge we should create:

- What should be continuously created? We believe we should create harmony between human - human, and human - manmade structures - nature
- Why should we continuously create harmony? UGM values: civilization, benefits for humankind, and happiness. To bring these values into reality we face continuous changes including climate change.
- How to achieve harmony from the global scale to the local scale.
- Who should participate in Adapting to Eco-system and Climate Change? Government, communities, industries and university should participate in adapting to eco-system and climate change to achieve harmony in prosperity, security, welfare and equity.

Who should participate in Adapting to Eco-system and Climate Change?

Here at UGM, our recommendation is for a new orientation of programs towards optimizing the use of limited resources. This new orientation

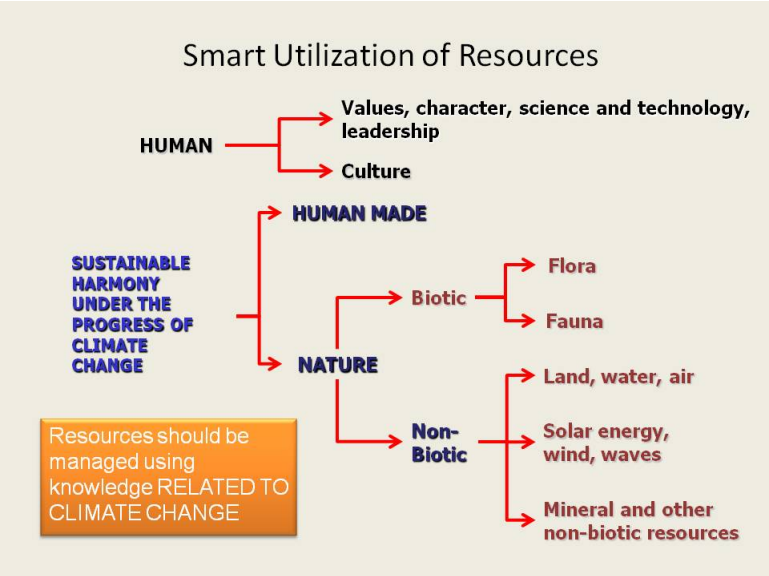


Figure 7.1: Goal to achieve smart utilization of resources

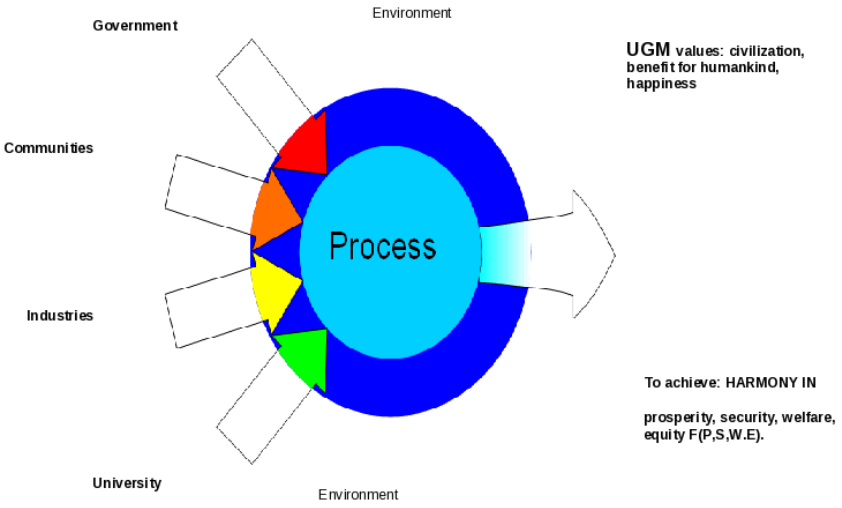


Figure 7.2

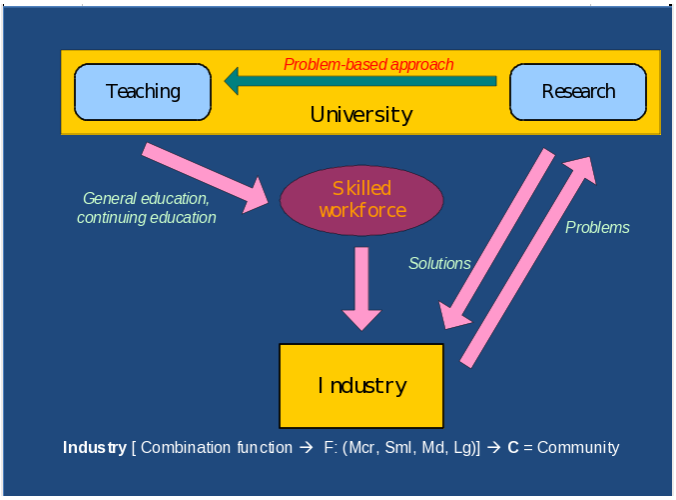


Figure 7.3: Building a skilled workforce transform of sustainable industries

should focus on how to contribute to society in adapting to climate change; the choice of which will depend on local condition and local wisdom.

Problem-based pertinent research will be conducted through university, general education and continuing education, which will foster a greater skilled workforce and finally transform towards more sustainable industries.

Education of eco-system and climate change adaptation in Indonesia

Higher education is tertiary education; it is the continuation of primary and secondary education. Participatory approaches (P) based on knowledge of local conditions are needed. The function of participatory approaches (P) includes many parameters: science, technology, politics, the economy, environment, culture and law. This function P can be explained in explicit knowledge that is available in literature, seminars, conference, and discussion notes. There is a need for knowledge creation that is both appropriate for local conditions and takes a participatory approach.

Figure 7.4: A group of elementary school students in Bantul manage their waste, sort the trash, reduce non-degradable waste.

As for the education in adapting to eco-system and climate change, practices in educating young students in primary and secondary education in Indonesia covers a limited numbers of schools. For example, some elementary school students are taught to manage their waste, sort the trash and reduce non-biodegradable waste; some school students have organized and promoted awareness on global warming.

For UGM's case, there is a strong need for continuous improvements related to primary and secondary education. Some examples of needed programs in UGM are:

- Research Exchange Programs based on Co-created Orientation Model, world participatory approach, optimization of ZAP (Zero Approach Planning)
- Education and Service to Communities based on research, should be enriched through partnership.
- Learning on Community Empowerment Programs (integrated in UGM Curriculum based on research)
- Integration of actions among UGM, Local Goverment, Communities, and Appropriate Industries/Business.

Experiences from UGM

The programs in UGM are conducted based on the local wisdom and the UGM's uniqueness. The programs in UGM are conducted based on the local wisdom and the UGM uniqueness.

Some example of programs that reflect the characteristic of UGM's vision are: the Student Community Service (SCS) and Curriculum Development (STAR approach).

One example of a good practice of climate change adaptation is networking development on waste refinery. Since 2006, local governments, the Ministry of Environment, Ministry of Home Affairs, Ministry of National Education and Ministry of Foreign Affair have established a network on waste refinery in Indonesia. The activities and result of this program are to build demonstration plant converting waste into energy

Figure 7.5: a) A rally of an islamic boarding school (Pesantren) students, call for people to care about global warming, b) Two kids' watching toys which is made from trashes in a Go Green Festival, Jakarta 2009

and fertilizer, improve social awareness and technical ability on waste management, and convert waste to valuable products.

UGM outreach program for community empowerment

UGM is well connected with local government networks. UGM is also currently appointed by the Directorate General of Higher Education of Indonesia as the national focal point for managing university network for student community service (SCS) outreach programs.

UGM played a very important role in the successful post-2006 earthquake rehabilitation and reconstruction programs for Yogyakarta and Central Java Region.

Student community service-community empowerment learning (SCS-CEL): The SCS program was initiated in 1951. It has been a compulsory subject for undergraduate since 1971. The main objective of SCS-CEL program is to increase empathy and solidarity of students toward the poor and the weak. This is considerably important since students are the future backbone of the nation. Students (supervised by faculty members) must stay and work together with community, usually in rural areas, for the least two months. For foreign students, their projects adjusted to match their period of stay in Indonesia, for example, they can undertake the community component in 1-4 weeks. This program is always upgraded to incorporate any issues which arise from the communitys' and faculty member research findings.

Conclusion

It is very important for UGM to build a learning community by transforming its learning process to be based on local wisdom and a philosophy of learning. The local wisdom and philosophy in learning is believed to create sustainable improved capacity to respond to both contemporary and future challenges of JE-institutions. The use of local wisdom and philosophy to refresh the learning process is believed to be important in building the character of graduates, which in the next process will guarantee the sustainability of the existence of the learning community.

INDONESIAN ENERGY OVERVIEW AND CHANGE ADAPTATION SCENARIO FOR INDONESIA ENERGY SECTOR

Herman Darnel Ibrahim
(Dr. ITB Indonesia, M.Sc. UMIST Manchester UK, Ir. ITB)
Member of Indonesia National Energy Council

Indonesia Energy Policy and Implementation at Present

The energy management in Indonesia is regulated by the newly enacted Energy Law No. 30 Year 2007. The Law mandates that the energy management shall be carried out to achieve energy supply security and sustainability and with maximum benefit for the Indonesian people. In the article 12, the Law stipulates the establishment of the National Energy Council (DEN) which has main tasks to (1) formulate national energy policy, (2) approve national general energy plan (RUEN), (3) decide remedy actions for national energy emergency and crisis, (4) set regulation on national energy buffer stock, and (5) supervise and coordinate the cross sector energy policy implementation. DEN is chaired by President and is the supreme institution for energy policy and its implementation.

The current National Energy Policy 2006-2025 (KEN 2025) was officially established by Presidential Decree No. 5 Year 2006. The policy has in fact addressed more renewable energy share in the energy mix. The decree targets, by 2025, that the use of oil should be less than 20%, natural gas should be more than 30%, coal should be more than 33%, biofuel should be more than 5%, geothermal should be more than 5%, other new and renewable energy (biomass, nuclear, hydro, solar, wind) should be more than 5% and coal gasification and fluidization should be more than 2%.

KEN 2025 has outlined 3 main policy frameworks i.e. energy diversification, energy conservation and energy pricing. For policy on energy diversification, the endeavours have been taken to maximize the renewable energy share, minimize oil share and encourage use of coal and gas to bring production costs down. To achieve these, the government has initiated to develop more renewable power plants such as geothermal, solar energy, biofuel, biomass, gasification and mini hydro. Besides, the government also tried to remove oil subsidy and transfer the subsidy budget for other uses, as well as constructing more coal power plant and distributing gas for houses.

The government also pays much attentions to energy conservation by maximizing the renewable energy share, selecting high efficient technologies, and focusing on demand and supply side efficiency. To realize these goals, the government runs several programs such as developing more combined-cycle gas turbine (CCGT) power plants, reducing energy loss in the transmission and distribution system, demand side conservation such as labeling the products, campaigning for the use of compact fluorescent lamps (CFL) as well as encouraging the use of mass public transportation.

Indonesia Energy Policy Has Been Rational But the Program Not Running Well . . .

Energy Policy [Current]	Initiatives and Programs
Diversification • Maximize Renewable Share • Minimize Oil Share • Use Coal and Gas to bring cost down	• Geothermal, Solar Energy, Biofuel, Biomass, Gasification, Mini Hydro • Remove Oil Subsidy • Coal PP, Gas for Houses
Conservation • Maximize Renewable Share • More Efficient Conversion • Demand and Supply Side Eff'cy.	• CCGT Plant • Loss Reduction • Labeling, CFL, Campaign • Mass Transport
Pricing • Market Price Primary Energy • Uniform Electricity Price • Subsidy Electricity and Oil	• Remove oil subsidy . • Competition on oil distribution • Subsidize Biofuel

Figure 7.6: Indonesia's energy policies and programs

The policy in energy pricing mainly are: market price of primary energy; regulated uniform electricity price nationally; and provide subsidy for electricity and selected oil users. Among the important initiatives in the pricing policy are: Removal of oil subsidy for industry; Introducing competition on oil distribution; and provide subsidy for biofuel.

Overall, Indonesia energy policy has been rational, however, some programs are not running well. In 2007, the review on energy policy and implementation has been carried out and some findings are :

- Good energy policy formulation is not an urgent priority for Indonesia at that time. The priority is to conduct a better coordination, timely decision making and sustained implementation policy.
- Accurate data and forecasting are the cornerstone for energy policy and decision making.
- Recommendation for the establishment of Directorate General of Energy Efficiency, Conservation and Renewable Energy under Minister of Energy and Mineral Resources.

As mandated by Law No 30 on Energy and in responding to the energy issues and challenge DEN is now working to review and reformulate the Indonesian Energy Policy 2010-2050, in which a more accurate and reliable energy consumption forecasting model is developed, and energy supply scenarios are addressed (including the energy change scenario in adapting to eco-system and climate change).

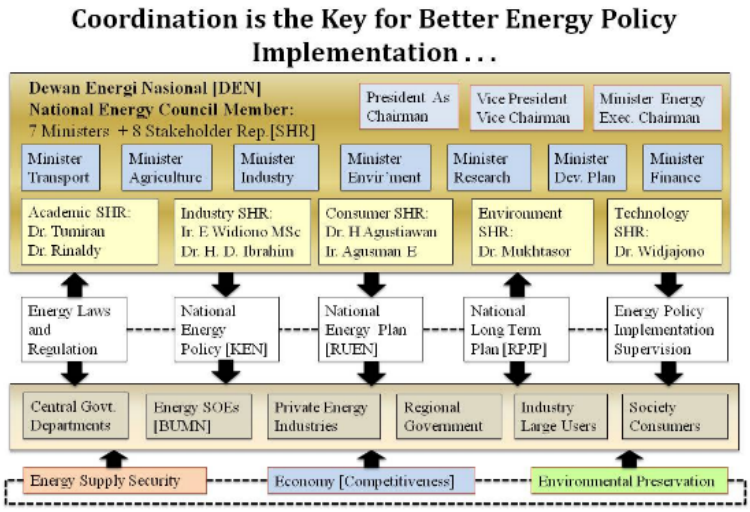


Figure 7.7: Energy policy implementation

Type of Energy	Reserve Potential	Reserve Explored	Exploited Capacity (2005)	Percentage Exploited
Hydro	75.000 MWe	6855 MWe	4125 MW	5.5
Geothermal	27.000 MWe	2288 MWe	1169 MW	4.3
Solar	1.200 GWe		8 MW	0.007
Wind	9.290 MWe		0.6 MW	0.0065
Biomass	49.810 MWe		445 MW	0.9
Peat	2.416 MTOE		0 MW	0
Tidal	240.000 MWe		0 MW	0

Table 7.1: Reserve potential of renewable energy in 2005

Current Energy Reserve and Consumption

The facts on energy reserve confirm that Indonesia is not a rich fossil energy reserve and resources country anymore. Unfortunately, most Indonesian people are not aware of this condition so that limited efforts have been made to address the issue. The Indonesian population is about 3.4% of the world population. The share of proven reserves of Indonesian energy fossil fuel are all below 3.4 % (coal; 0.58%, gas: 1.7%, oil: 0.36%), which means that Indonesia's proven reserve level is below the world average. On the other hand, the potential for renewable energy resources in Indonesia is abundant. However, due to the high investment and production cost required, its development is moving slowly and utilization remains very limited. Table 7.1 outlines the reserve potential of renewable energy in 2005 :

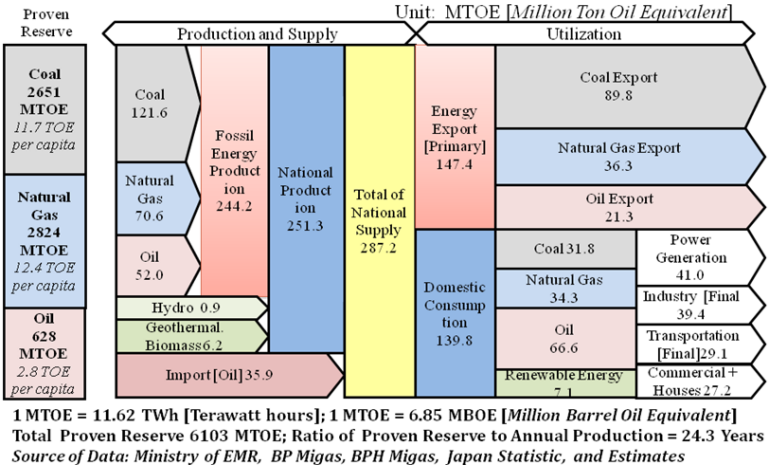


Figure 7.8: The Estimate of Indonesia Energy Flow

Figure 7.8 shows the estimate of energy flow in Indonesia during 2008 period. In the past and until recently, the Indonesian economy still relies on the exports of energy resources. In the past year, energy exports contributed to around 30% to government income. In 2008, the primary energy (coal, oil and natural gas) exports reached 147.4 MTOE (Million Ton Oil Equivalent) while the domestic consumption was 139.8 MTOE. The total of national energy supply was 287.2 MTOE, of which 251.3 MTOE came from domestic production and 35.9 MTOE (oil) was imported. Meanwhile, Indonesia also exported as much as 21.3 MTOE of oil. The domestic consumption of oil is largely for 4 main uses: i.e. power generation (41 MTOE), industry (39.4 MTOE), transportation (29.1 MTOE), and commercial and houses (27.2 MTOE).

Even though Indonesia has had tremendous growth of its energy development in the past 40 years, in fact Indonesia energy consumption is still far below the world average. Electricity consumption in Indonesia is only 567 kWh per capita, while the world average is 2,610 kWh per capita. The primary energy consumption per capita in Indonesia is 0.6 TOE per capita while the world's average is 1.72 TOE per capita.

As energy consumption is still low, Indonesia contributes less carbon emissions to the global aggregate. In 2005, Indonesia's CO_2 emission per capita was far below the world average, Indonesia was 0.425 kWh per capita, while the world average was 1.14 kWh per capita. Table 7.3 outlines Indonesia's Carbon Emission in 2005.

Energy Issues and Challenges

Oil Energy

The fact is that Indonesia has now become a net oil importer. In 2008, the oil reserve was 8.2 billion barrels, proven reserve was 4.3 billion barrels, annual production was 356 million barrels, export of crude was 146 million barrel, import of crude was 93 million barrel, import of refined

Energy	Unit	Indonesia	World
Oil Reserve	Billion Barrels	4.3	1,208
Oil Reserve per capita	TOE per capita	2.8	27.2
Gas Reserve	TCF	112	6,405
Gas Reserve per capita	TOE per capita	12.4	25.2
Coal Reserve	Billion Tons	5.3	909
Coal Reserve per capita	TOE per capita	11.7	78.2
Electricity Consumption	TWh	229	16,733
Electricity per capita	kWh per capita	567	2,610
Primary Energy Consumption	MTOE	136.7	11,200
Primary Energy Consumption per capita	TOE	0.60	1.75
Energy Intensity	TOE per $ Million	485	201

Table 7.2: Indonesia Energy Consumption and Reserve 2008

Energy	Unit	Indonesia	World
Primary Energy Consumption	MTOE	128	10,311
Renewable Energy	MTOE	6.2	504
Renewable Energy Share	%	4.8	4.8
Fossil Energy	MTOE	121.8	9,085
Fossil Energy Share	%	95.2	88.1
Oil Energy	MTOE	65.8	3,831
Oil Energy Share	%	51.4	37.2
Electricity share in Final Energy	%	11.0	18.8
CO_2 Emission		93.7	7,280
Emission Factor	TWh	0.73	0.706
CO_2 Emission per capita	kWh per capita	0.425	1.14

Table 7.3: Indonesia's Carbon Emission in 2005

oil was 153 m barrels and oil consumption was 384 million barrels. The important issues in oil exploitation are: lack of exploration activities, degradation of proven reserve, critical reserve, and insufficient refinery capacity. The challenges are then how to increase exploration activities, increase capacity of refinery, buffer stock to secure supply, control of export to conserve resources, and removal of the subsidy.

Natural Gas

Even though Indonesia exports gas, it still experiences a domestic supply shortage. In 2008, natural gas resources reached 162 TCF, proven reserve was 112 TCF, production was 2.8 TCF, export was 1.44 TCF, no import of gas and consumption was 1.36 TCF. The main issues are lack of exploration activities, degradation of proven reserve, critical reserve, export is greater than domestic use, lack of distribution (pipelines) infrastructure, and lack of supply for domestic. Some endeavours shall be taken to answer the challanges by increasing exploration activities, expanding the use of gas in industry, transport and households, controlling exports to conserve resources, building storage infrastructure, LNG terminal and LPG filling stations, and developing pipelines network.

Coal Energy

The Fast Track Program (FTP) phase 1 to build 10,000 MW coal power plants along the country was designed for maximizing coal utilization. Coal is the future of Indonesia energy for security supply and price, but the exports are still growing. In 2008, the coal reserve was 18.7 Billion Tons (BT), proven reserve was 5.3 BT, production was 243 Million Tons, export was 182 Million Tons, no import of coal, consumption was 61 Million Tons and CBM potential was 453 TCF. The main issues are lack of exploration activities, degradation of proven reserve, no depletion premium regulation, reserve is not so big, too much export than domestic use, lack of transport infrastructures and domestic supply is not so secure. The challenges in this sector are how to increase exploration activities, develop integrated transport infrastructure, control export to conserve resources, develop national stockpiles, and conduct more exploration and exploitation of CBM as new energy sources.

Geothermal Energy

Geothermal Energy is a clean and promising energy source for Indonesia. In 2008, the geothermal resources was equal to 28,000 MWe, proven reserve was 2,288 MWe, capacity in production was 1,189 MW. The new project planned part of the 2nd phase of the 10,000 MW project is 4,700 MW; of which 2,100 MW is located in Java Bali system and 2,600 MW is outside Java Bali. The main issues are: project preparation survey and Feasibility Studies (FS), less exploration activities, fields overlapping with forestry and national park area, pricing not being financially attractive, tender mechanism (by local government) and project funding. The challanges are how to fund for project survey and preparation,

speed up of exploration and development, decision making for pricing, improve tendering processes, and project funding especially for small scale.

Hydro, Solar and Biomass Energy

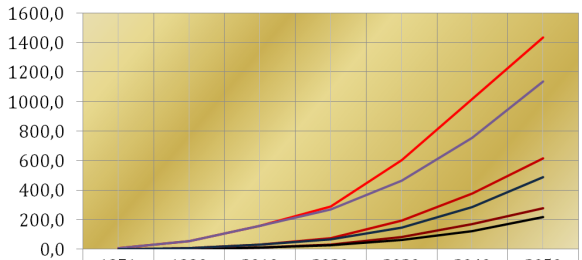
Most renewable energy technologies are still expensive to develop. In 2008, the hydro resources achieved 75,000 MWe and solar energy was 1200 GWe. Due to economic constraint, the project implementation tends to be slow and almost not growing. Meanwhile, the biofuel development is also slow as price of oil relatively low. The main issues in this sector are less (risky) activity in project preparation (survey and exploration), pricing is not attractive as PLN tariff is relatively low, most players are local and weak in capital and management capacity. The main challenges are how to fund for project preparation, survey and FS, make an appropriate decision for better pricing or incentives, conduct a capacity building for local and small players, and domestic project funding for small scale.

Electricity Supply

Altough the government have already accelerated the electricity supply by implementing the 10,000 MW phase 1, the gap between demand and supply is still getting wider. Due to slow development, new constructed power plants are less than 5,000 MWe in the past 10 years. In 2008, energy sales are steadily growing 6 to 7 % per annum. Out of 6000 MW, only 75 MW has been completed and 981 MW is under construction by IPP PPA. The electrification ratio is still 60% and with more than 11,000 villages still without electricity. The main issues are: the costs are based completely on the market price, but tariff is regulated (no tariff change since 2003), lack of generation and T&D facilities development, frequent power shortages outside of Java: Bali, Sumatera, and Kalimantan, and the cost of production is still high (about 11 cents for old and oil-fired plants). The challenges are tariff adjustment to reduce subsidy and improve PLN financial, deployment of fund to escape from power shortage outside java, funding to reduce production costs, and funding for remedy of transmission and distribution congestion.

Energy for Rural

In 2008, out of 71, 000 villages, there are about 59,000 villages have received electricity. It is the almost 25 million unelectrified families that are mainly are located in rural areas. For rural families, the use of (subsidized) kerosene was still 5.8 Million kiloliters. At that time the government planned to provide LPG tank for 40 million families (kerosene substitution program). The main issues are: limited fund for rural electrification only for around 250,000 connection per year, electricity supply from PLN grid is limited due to power shortage, local government participation on rural energy is still limited due to budget constraints, and progress on development of LPG filling plant station



	1971	1990	2010	2020	2030	2040	2050
Electricity High, MTOE	0,2	1,1	12,7	31,2	83,5	170,0	278,8
Electricity Moderate,MTOE	0,2	1,1	12,7	29,4	63,5	123,9	218,8
Prim Enetrgy High, MTOE	8,8	58,2	159,9	289,5	605,9	1018,6	1435,6
Prim Energy Moderate,MTOE	8,8	58,2	159,9	271,8	467,3	758,1	1138,0
Generation High, GW	0,6	10,3	31,6	75,7	194,8	378,9	618,0
Generation Moderate, GW	0,6	10,3	31,6	68,7	147,2	287,2	489,0

Figure 7.9: Projection of Indonesia Energy Consumption Towards 2050

(SPBBE). The challenges are: how to provide more funding for rural electrification, develop more facilities for providing LPG at rural areas, improve local government participation and improve oganizational structures for rural energy development.

Indonesia Energy Change Adaptation Scenarios

Energy Change Adaptation Scenario No.1: Provide future huge energy consumption while conventional energy supply is more limited.

In the past 40 years, Indonesia has had remarkable growth in energy development. Electricity consumption grew on average 12% per year. Consumption increased more than 80 times, and it is now at 150 TWh in 2010. The primary energy consumption increased more than 18 times, from only 8.8 MTOE in 1971 to almost 160 MTOE in 2010. The average growth is 9.2% per year. The quick projection result means that for sustainable economic development, we still need to create high growth in energy. The projected electricity growth is about 6 to 8 % and primary energy growth is about 5 to 6 % . Figure 7.9 shows Indonesian energy consumption from 1971 and its projection up to 2050.

Energy Change Adaptation Scenario No.2: Find the path to grow energy supplies and make it low carbon

The share of Indonesian population to world population is 3.36%, but the share of Indonesia's energy consumption is only 1.2% (in 2008). Indonesia consumes energy below the world average. GDP per capita of Indonesia in 2008 was US$ 1,240, while the average world GDP is US$ 8,300. USA and Japan are the two countries which have GDP above US$ 35,000 per capita per year. In reality, developed countries (such as the OECD) produce high GDP and also consume large amounts of energy (large consumption of carbon). GDP per capita is linear to the energy

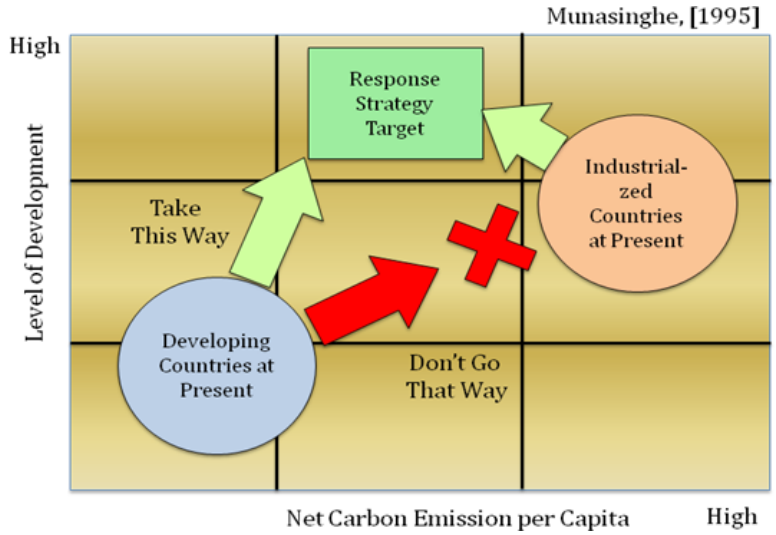


Figure 7.10: New Path for a Low Carbon Sustainable Development

consumption per capita. The main challenge of future development to be that of a wealthier country that can provide larger amounts of energy while producing low carbon emissions, based on a new development path that does not follow the path made by developed countries in the past. Figure 7.10 illustrates the new path for Indonesia in the future and the old path made by the developed countries.

Energy Change Adaptation Scenario No. 3: Grow the GDP and lower the rate of energy services and intensity.

The basic equation to address the energy efficiency and conservation has been formulated by Kaya (Kaya 1989) as follows:

$$E = \left[\frac{E}{ES}\right] \times \left[\frac{ES}{GDP}\right] \times \left[\frac{GDP}{P}\right] \times P$$

where E = Energy consumption (TOE per year) , ES = Energy Services (capita km per year), GDP = Gross Domestic Product (Rp per year) , P = Population (people)

In general P will grow and increase. The objective of development is to increase the (GDP/P). Conservation will be made by two means, first by improving the demand side efficiency i.e. to lower the (E/ES) and second by improving the energy services intensity i.e. to lower the (ES/GDP).

Energy Change Adaptation Scenario No.4: Push renewables, nuclear is important for balancing of economy and sustainability.

Figure 7.11 illustrates the merits of environmental sustainability and production costs of various energy types. Coal receives high merit

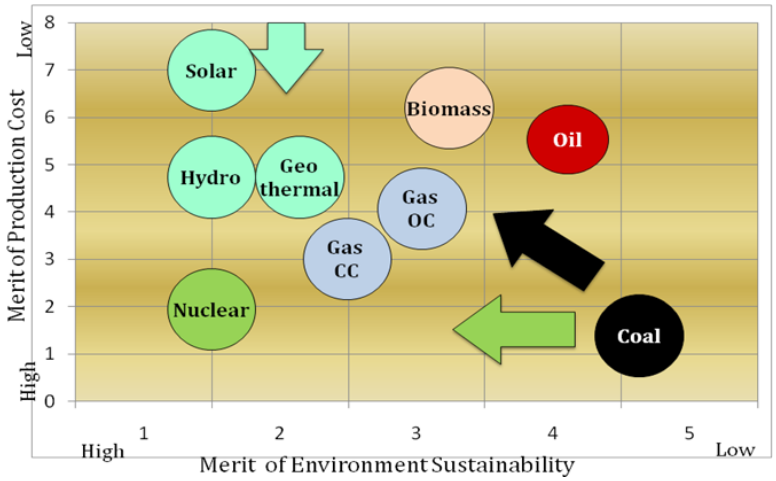


Figure 7.11: Production Cost and Environmental Merit of Various Energy Type

on production costs, but its environmental merit is the lowest as its produces the highest carbon emissions. Oil is in low merit in both production costs and environmental sustainability. Gas is in the middle i.e. moderate in production cost and moderate in environmental sustainability. Renewable such as solar, hydro, and geothermal are in high merit of environmental sustainability, but low in merit of production cost. Nuclear is in high merit of both production cost and environmental sustainability.

The ideal energy change adaptation scenario for Indonesia is to push, as much as possible, (attractive) renewable energy into the energy mix while minimizing the use of oil and optimizing the use of gas. Coal is important to provide adequate and more economy in production costs. Nuclear is important to provide security of supply in terms of supply and price and reach a balance with environmental sustainability.

Energy Change Scenario No. 5: Energy Mix which balance the security, economy and environmental sustainability.

Each type of energy has its unique characteristics. All energy in general is good as they are useful. As illustrated in figure 7.12, there are three main constraints in deciding the future energy mix of Indonesia i.e. Security of Supply, Economy of Supply and the Environmental Sustainability. Security of supply is the ultimate goal in energy management. The economy is important as the energy price must be competitive to that of other countries. Sustainability is important as to minimize the environmental impact.

The ideal energy type to provide security of supply and price are: more renewable such as solar, hydro, geothermal and biofuel; less fossil energy as to reduce the impact of oil price dynamic and the nuclear power. For the economy of supply, coal is the main energy source and nuclear is a necessity. Some attractive renewable (hydro and geothermal) must also be provided. The ideal mix for sustainability are: renewable;

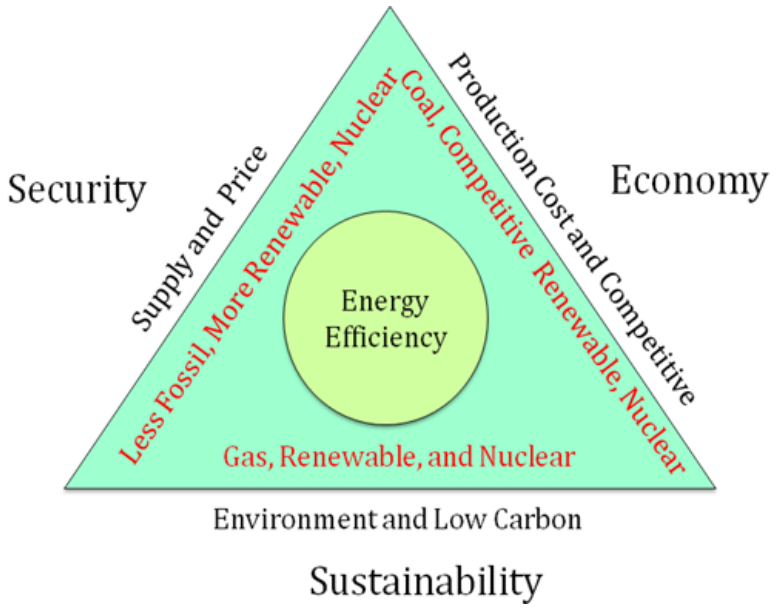


Figure 7.12: Balance of Security, Economy and Environment Sustainability

nuclear and gas. Energy efficiency is a universal solution that provides security, economy and sustainability, so that it is an absolute must for future energy use.

Summary and Conclusions.

From the above description some important conclusions and recommendations for energy change adaptation and future energy management are:

1. It is important to change the paradigm and the mindset that Indonesia is not rich with fossil energy resources.
2. Greater energy efficiency in both the supply and demand side are an absolute need for energy change adaptation. Energy efficiency measures can be made attractive by using incentives, as well as supported or enforced by regulation.
3. In the future, use cheaper energy for domestic (Coal and Gas) and only export expensive energy (Oil and Biofuel).
4. Maintain and increase energy resources and reserves by doing and spend more for exploration activities.
5. Indonesia has to develop competitiveness of its renewable energy (Solar and Biomass) by spending more on Research and Development, leading to competitive domestic production.

6. Push all renewable and low carbon energy (within the competitive limit) but do not let our coal burn overseas because it is cheaper, as it still produces emissions over there.

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ENERGY SECTOR MITIGATION AND ADAPTATION STRATEGIES ON CLIMATE CHANGE (MEDCOENERGI'S INITIATIVE)

Budi Basuki
President Director PT. Medco E&P Indonesia [1]

Abstract

The effects of climate changes are irreversible and can endure the living conditions for humans, therefore many governments, international organizations, and industries have promoted the development of strategies to mitigate and adapt regions to climate change.

Oil consumption as one of Indonesian energy resources which increase 5% per year is not followed by the increase of production which is only 2% per year. This unequal condition stimulates energy sector to increase their activities continuously in order to boost the production up. Increasing energy demand, inevitably led to the increase of emission, which is one of any causes of climate change.

The aims of this paper are describing MedcoEnergi's (Medco's) contribution as one of energy industry in Indonesia in actively participating in the effort of mitigating and adapting climate change in Indonesia and represent oil and gas industry's views and expectations of climate change.

Introduction

Energy is important thing to our life. It cannot be denied that we could not live without energy, so the effort on exploiting energy resources is performed continuously. Energy-making activity during this done on nonrenewable energy sources, such as oil and gas, and that activity is being encouraged to be increased since the consumption is not equal to the production.

Energy condition in Indonesia is shown in figure 7.13and 7.14. It is clear enough to see that the needs of energy (in figure 7.13 is electricity) will be increased year by year, so does the other form of energy. Figure 7.14 shows us that oil production is lower than the consumption and these conditions resulted in various energy sectors to increase their production.

The energy crisis becomes more complicated by the realization that fuel subsidies increase beyond the plan. As can be seen in figure 7.15, during the year of 2004-2008, fuel and electricity subsidies had increased and table7.4 shown the amount subsidies which was implemented compare to planned and indicates our dependence on petrol fuel compare with LPG and electricity is still high.

Recent years, world is faced with the fact that earth is getting warmer and climate change threats lives. Energy sector which is one of the

1 International Conference on Climate Changes, Yogyakarta , March 8, 2010

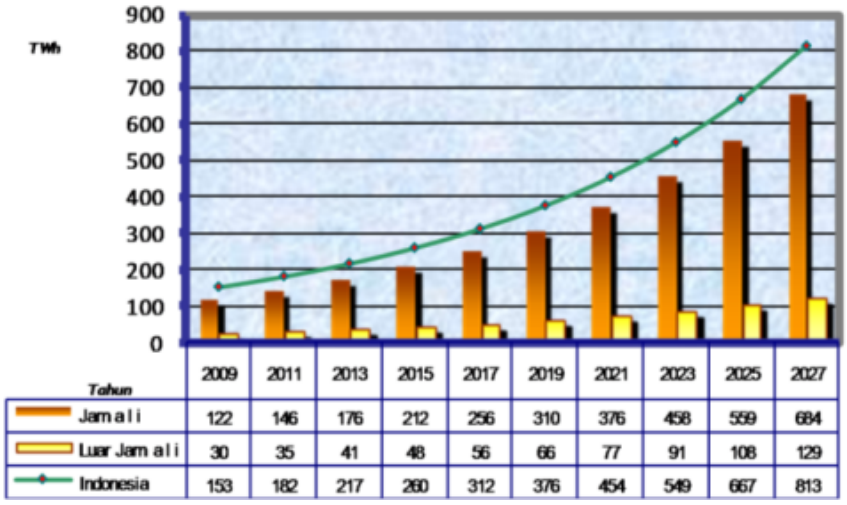


Figure 7.13: Estimated Electricity Need

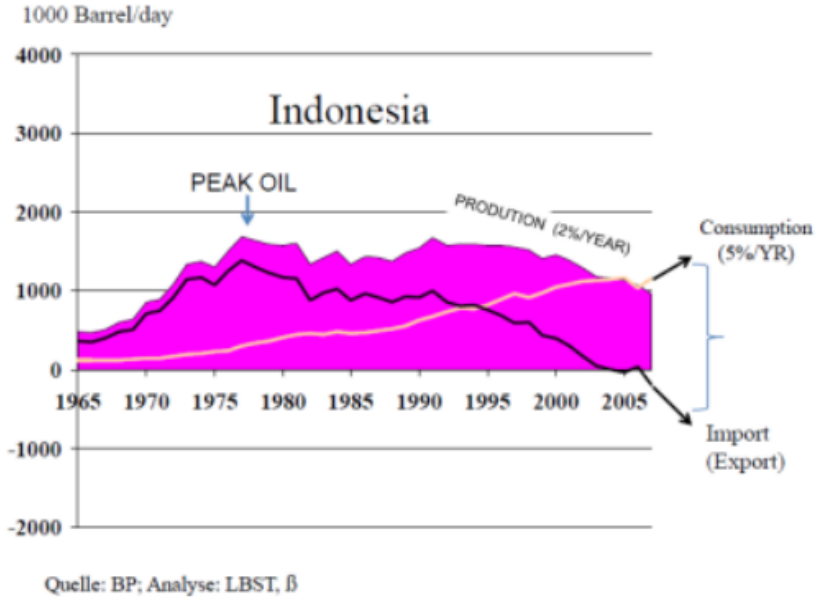
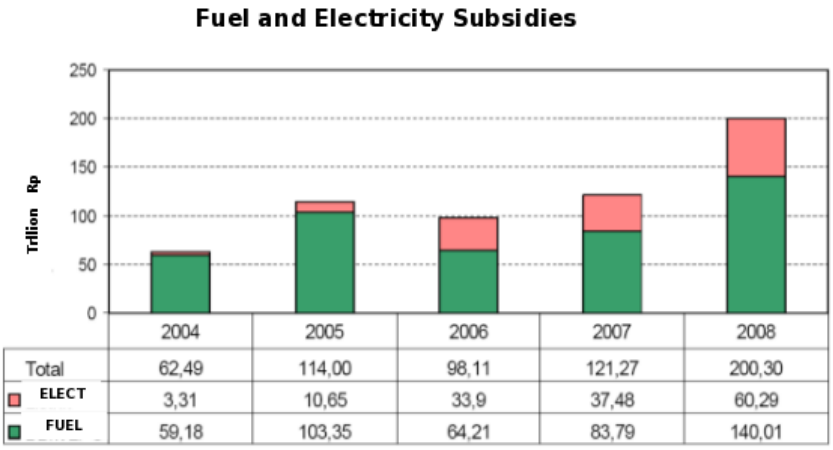


Figure 7.14: Oil Producton vs Consumption

Type	Plan*	Implementation*
Petrol Fuel	114,646	134,409
LPG	9,565	5,597
Electricity	61,010	60,290
Total	185,221	200,296

Table 7.4: Estimated, Plan, and Implementation of Indonesia Electricity Subsidies

Note : *in billion Rupiahs



	2004	2005	2006	2007	2008
Total	62,49	114,00	98,11	121,27	200,30
ELECT	3,31	10,65	33,9	37,48	60,29
FUEL	59,18	103,35	64,21	83,79	140,01

Figure 7.15: Indonesia Fuel and Electricity Subsidies

contributors to emissions as one of the causes of climate change should be actively involved in minimize the impact of their activity through adapting and mitigating the change since the increased of energy in line with the increase in emissions as can be seen in figure 7.16.

Figure 7.16 shows us, the increase of energy need, increase the carbon emission. In 2008-2025, the carbon will be increased by 321% from 722,760 tonnes CO2e to 2,323,610 tonnes CO2e per day so that it can be said it is natural that the emissions will be increased with the increase of energy need and the only solution to climate change caused by energy supplying activity is adapting and mitigating to it.

MedcoEnrgi's Initiatives: Emission reduction and energy efficiency

Emission reduction

For oil and gas industry, especially exploration and production one, global warming reduction effort is not only by doing reforestation only, but how to minimize the emmission released to the environment, since one of biggest emission source comes from gas flaring activity that used by oil and gas industries to combust their associated gas.

Reforestation is absolutely important to restore the environmental quality equilibrium, and in this effort, Medco has been replanting 491 hectares land since 2006 within 213,617 trees. Medco is also commited in replanting twice as much as of cleared area. Refer to there research by Manuel Enrique Figueroa from the University of Sevilla, replanting those amount of trees equals to reduce 5,767,659 tonnes CO2e.

In order to minimize the amount of carbon released to the ambient air, Medco has been doing some gas flaring reduction projects through utilizing the associated gas into electricity supply, and city gases. In pilot project, Medco is trying to combine heat and power, and also fuel switching in energy efficiency improvement projects.

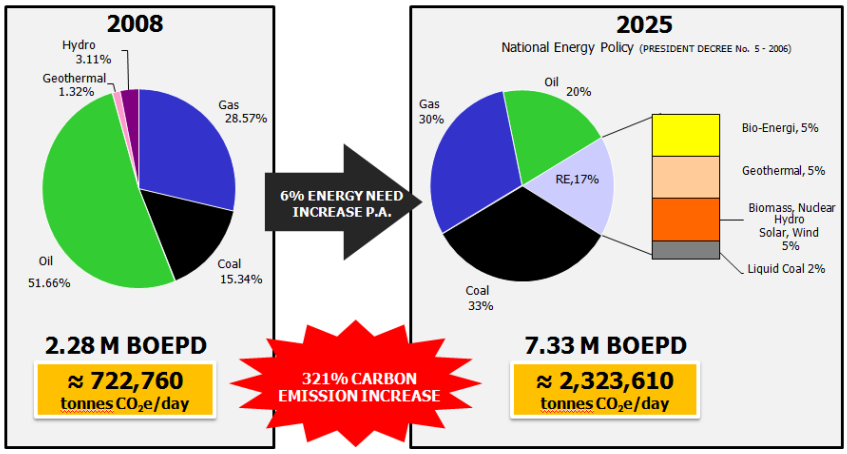


Figure 7.16: Estimated Electricity Needs and Oil Production vs Consumption

Associated gas comes within the oil that has been explored. This gas is usually combusted in flare which produces emissions that have a big contribution in global warming. To minimize the amount of carbon released to the ambient air, Medco is trying to reduce gas flaring through utilizing the associated gas 5 into liquefied petroleum gas (LPG), gas monetizing for electricity supply and fertilizer industry, fuel, and gas lift. The scheme of those processes can be seen in figure 7.17.

Refer to figure 7.18, the projected reduction of CO2 from associated gas utilization in Medco is around 1,962,280 tonnes or equals to the emissions from 19,549 cars daily.

During 2009, Medco had utilized around 10,109,191.51 MMSCF associated gas or equal to 524,565.9475 tonnes CO2 equivalent. This gas utilization reached 81% from the associated gas production and had been increased by 20 % from 2008 which had been utilized the gas around 61 % from the production.

The treated associated gas is also used for electricity supply and fertilizer industry. Almost 60% power plants' gas supply in South Sumatera are provided by Medco. Rather than simply burned, associated gas is also used for maintaining the reservoir pressure through gas lift by injecting the gas to oil reservoir and powered some engines for internal operation.

In pilot project scale, Medco substitute kerosene into gas for domestic use, which is known as City Gas project, that has been applied in few cities, had already known lower the CO2 emissions into 233.6 tonnes equivalent per year. Fuel conversion project from diesel fuel into gas in our several fields for internal operation had already known to reduce 5,577.5 tonnes CO2 equivalent per year. Compare to diesel fuel, gas fuel could reduce CO2 emissions by 30-40 %.

Refer to figure 7.14, petrol fuel is still a favorite for consumption, whereas the efforts on fuel conversion will certainly improve our national economic by reducing the amount of subsidies. Based on projec-

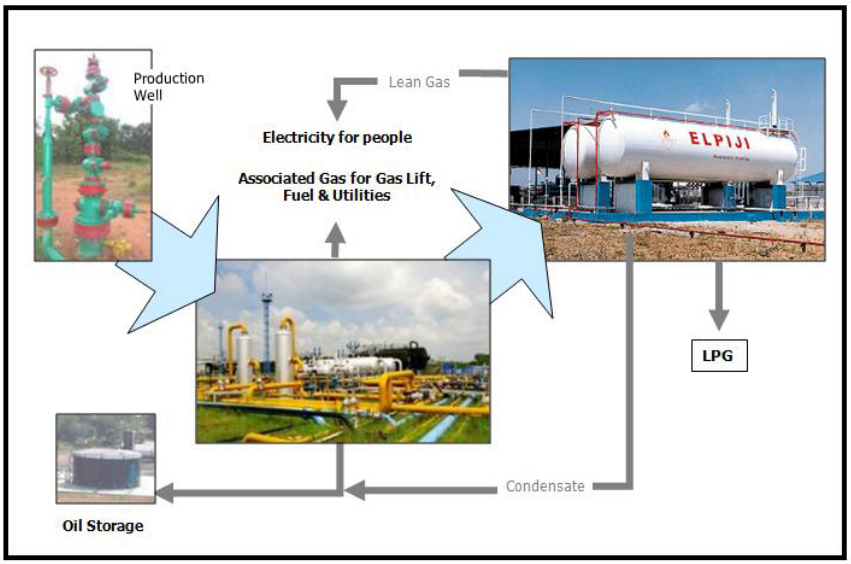


Figure 7.17: Associated Gas Utilization in Medco

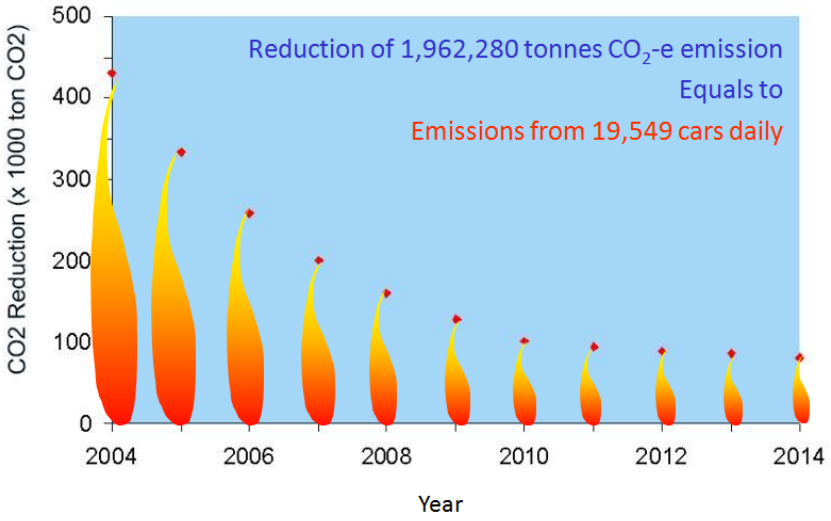


Figure 7.18: CO2 Reduction from Associated Gas Utilization

tion, national saving which can be achieved if we convert petrol fuel into gas fuel is around 60 trillion rupiahs.

Since natural resources efficiency is another way in mitigating the climate change, in render efficient the resources, Medco also conducts some projects related to it, among others reducing fresh water demand by reusing treated domestic waste water and reusing industrial waste.

Supporting Organic Farming: Mitigating and adapting effort through CSR

Most of our operation area is located in rural area with agricultural, plantation, and farm potential. Therefore, through community social responsibility (CSR) program, we are focusing on local community empowerment based on the capacity approach. Empowerment is in a form of training, mentoring, and aid instrument.

One of our programs is supporting organic farming which is known as System of Rice Intensification (SRI) Organic which technically cheaper, easier, more resilient to water shortages, and combating methane emission from conventional farming where methane is known as one of green house gases which contributes in climate change.

With the use of compost, production cost will be reduced, land and rice field ecosystem could be improved, and align with the improvement, the harvest will be increased. It is known that harvest from SRI organic increased by 300% than the conventional one. Rice seedling which is needed by organic farming (5 kilograms per hectares) is less than the conventional needs (45 kilograms per hectares), so farmer's income will be improved since the production cost decreased and the harvest increased. The detail of the comparison is shown in Table 7.5.

And how this kind of farming adapts and mitigates climate change? The pattern of this cultivation is aiming to reduce water usage to the rice field, which has already known that in the water lack condition, methane production by anaerobic microorganism will be reduced or even stopped. Besides that, the hays from harvest waste which is usually burned and yield green house gases such as CO and CO2 will not last long because the hays needed for compost raw material. Research study showed this kind of farming decreased methane production until 67%, better than conventional farming.

Refers to Production, Harvested Area, and Yield of Paddy in Indonesia, 2005-2009 collected by Statistics Indonesia and Directorate General of Foodcrops, in 2009, Indonesia harvested 12,669,000 ha paddy, so there is a big potential of emission from conventional farming can be reduced by applying organic farming. That is around 4,535,502 ton CO2 equivalent.

Potential Projects

Medco realizes that energy is a non renewable resource and future trend tends to change into renewable resource consumption, thus Medco carries out ethanol production through Bioethanol Project that processing

Item	Conventional System	Organic SRI
Land Size*	17.6 Ha	15 Ha
Rice Varieties*	IR 64, Gogo, Ciliwung, dan Bengawan	Sintanur & Cigelis
Harvest Season*	February-March 2009	July 2009
Average Pesticide Use*	100% / Ha	0% / Ha
Average Non Organic Fertilizer Use*	90.3% / Ha	0% / Ha
Average Organic Fertilizer Use*	9.7% / Ha	100% / Ha
Harvest**	1.65 Ton/Ha	7-8 Ton/Ha (increase 324-384% / Ha)
Methane Gas Production***	83.98 gr/day/Ha	7-8 Ton/Ha (Decrease 67%)
Emission (kg CO2 e/ha)	707	349
House Compost Production	-	5-7 Ton/Ha

Table 7.5: Pre and Post Implementation of Organic SRI Program, Suka Makmur Village – District BTS Ulu, South Sumatra

Notes :

* : Agriculture Survey, Ratih Ineke Wati, Faculty of Agriculture UGM, 2009

** : Calculation result "average per 14 m²" paddy harvest in Suka Makmur Village

*** : Field analysis data result based on Ardi Fitri research, IPB : argue in 14 days after planting, the rice yield conventional systems produces methane gas 0.35 mg/m²/hour whereas the Organic SRI produces only 0.1 mg/m²/hour

cassava into ethanol which is done in another Medco Energi unit business. There still some potential climates change mitigation activities, such as Sarulla Geothermal Project and Singa & Block A CO_2 Injection Project.

Based on 2008 national fuel consumption, Indonesia spends fuels for vehicles around 138,000 million barrels, consist of 68 million barrels gasoline and the rest is diesel. The amount of gasoline is equal to 299,200,000 tonnes CO_2 equivalent, while diesel is equal to 352,100,000 tonnes CO_2 equivalent. If the fuel converts to LPG, we will reduced CO_2 emissions from gasoline around 32% and 41% from diesel oil. Learns from the facts, Medco is going to develop this fuel conversion project in the wider scale, as a responsibility to minimize the climate change impacts.

Constraints, Challenges, and Opportunities

At the policy making level, we have the Kyoto Protocol, that encourages the reduction of CO_2 emissions. Yet, all of this remains under a satisfactory level because we are simply witnessing series of rounds or environmental talks that have barely drawn a conclusion on even the mandatory level for all governments in their commitment to carbon reduction.

Technology limitations in managing green house gasses emission and also lack of underlying finance since all of those activities mentioned need bigger investment, around 2 to 3 times than normal and standard process, become constraints and challenges which are currently faced by energy sector in the climate change mitigating and adapting efforts.

Project study carried out by academic institutions is still limited to the study of the ideal and not in harmony with the problems of the industry while there are many opportunities between academic institutions and industries to develop some projects related to mitigate and adapt climate change.

Consider that oil and gas industry is a non renewable one, so we are always find out the better ways for our environment and community around us. That is the reason why our CSR vision is achieving sustainable development in our operation area. We hope that during our operation and post operation, we could improve the community ability and welfare, so in the future of their lives do not depend on our industry. This approach encourages community self-confidence to develop advanced and keep the minds that to go forward must not rely on external parties.

Conclusion

Based on previous discussion, it can be conclude that climate change is our business. It is an actual threat, so quick and concrete steps of adaptation and mitigation are mandatory. It is not just problem for particular party, so it should be conquered in line by industries and

academic institutions. The 9 discussions and projects related to climate change must aim to clearly solution finding in a measurable timeframe, in order to maximize the results.

Disclaimer

This document contains certain results of operation, and may also contain certain projections, plans, strategies, policies and objectives of the Company, which could be treated as forward looking statements within the meaning of applicable law. Forwards looking statements, by their nature, involve risks and uncertainties that could cause actual results and development to differ materially from those expressed or implied in these statements. PT MEDCO ENERGI INTERNASIONAL TBK. does not guarantee that any action, which should have been taken in reliance on this document will bring specific results as expected.

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8

THEMATIC SESSION 2

EDUCATION FOR SUSTAINABLE DEVELOPMENT IN INDONESIA

Retno S. Sudibyo & Eko Agus Suyono
UGM

National Coordinator of EfSD Implementation

The National Coordinator for ESD Implementation Office is located at, and coordinated by the Office of Indonesian National Commission for UNESCO (KNIU) in Jakarta. The Office was established in the end of 2009, and started to coordinate the implementation of ESD at all levels of education in Indonesia in 2010. The establishment of the National Coordinator Office of ESD has been being considered to be effective for integrating the needs and beneficiaries in the design stages of ESD implementation across institutional boundaries.

The establishment of the National Coordinator Office of ESD is effective in integrating the planning, monitoring, and evaluation of, as well as improvements in, established programs and in the construction of contextual programs related to the implementation of ESD.

The Implementation of EfSD in Indonesia

Since 2009, the responsibility for planning and implementation of EfSD in Indonesia has been transferred from the Ministry of Environment to the Ministry of National Education. A National Coordinator of EfSD Implementaion (NC-ESDI) was appointed.

Four Directorate Generals were selected to take responsibility of:

- Non Formal and Informal Education
- Management and Education of Primary and Secondary Schools
- Quality Improvement of Teachers and Education Personnel
- Higher Education

They have actively been involved in the introduction, development and implementation of EfSD related Programs.

Some Ministries and Research Institutions have also joined to implement some EfSD Programs. Regular ESD Coordination Meetings occur between NCESDI and Ministries of: National Education, Health, Environment, Agriculture, Forestry, Marine and Fishery, Research and Technology, Home Affairs, Industry, State Ministry of Women Empowerment, State Ministry of Remote Regions, and Foreign Affairs, as well as Indonesia Institute for Science and some NGOs.

Implementation of ESD in Higher Education (HE):

- Establishment and Implementation of ESD-based SCS – CEL Program in Higher Education at the National Level
- Conducting ESD Workshops and Disseminations
- Nurturing Local Government on ESD Implementation

In Indonesia, all HE Institutions must conduct "Tridharma" - the HE's Main Tasks of: Education, Research, and Community Service.

Since 2009, The DGHE and NC-ESD have been working together in introducing, developing and implementing Sustainability to the Education, Research and Community Service programs and activities in HE.

In 1971, UGM established a Student's Community Service (SCS) Program, which in 2005-2006 the program was improved to be a very special and unique student activity based program, namely SCS-CEL Program (Student Community Service – Community Empowerment Learning Program).

Since 2007, the SCS-CEL program has been adopted by the Directorate of Research and Community Service of the DGHE, to be implemented in HE institutions across Indonesia; and UGM has been appointed as the coordinator of SCS-CEL implementation.

Since 2009, the DGHE together with UGM have initiated implementation of EfSD -based SCS-CEL Programs. An example of one program is Disaster Mitigation.

SCS – CEL Program of UGM (ISO 9001:2008)

This program is a compulsory subject for college students. The UGM sends about 7000 SCS-CEL students per year to the fields. The Program is based on the empowerment paradigm, with the objective of raising student's empathy and care for the poor and for environmental problems. The program is conducted through principles of: Win-win solutions; Co-creation; Co-financing; Flexible; Sustainable; Transparent and Accountable. SCS-CEL is also a research based program, using multidisciplinary approaches and methods. Outputs and outcomes are measurable in order to ensure improvements in sustainability. The program should be supported by collaboration or partnership between UGM and local government, industry, or other institutions, either nationally or internationally.

Implementation of ESD in Directorate General of Non-formal and Informal Education

The Directorate General initiated a competitive grant to select ESD-based community learning at the national level in October 2009. To increase the awareness of teachers and educators towards ESD-Implementation, in every training program held by the Directorate, NCESDI always sent

its experts to disseminate the concept and implementations of ESD to strengthen on going programs as well as to create ESD-based innovative programs.

Dissemination of ESD Implementation throughout the Country and in International Communities

ESD implementation has been actively disseminated at various events such as:

- International Youth Conference in Banten, West Java, Indonesia with the topic "The Role of Education in the Establishment of Peace through Sustainable Development: SCS-CEL Program, A Good Practice in UGM".
- APEID Conference, Bangkok, Thailand, on the topic "Implementing Student Outreach Program in the Community".
- International Conference on ESD for Higher Education, Okayama, Japan, with topic The Role of HE for ESD Implementation through Community Sevice Program

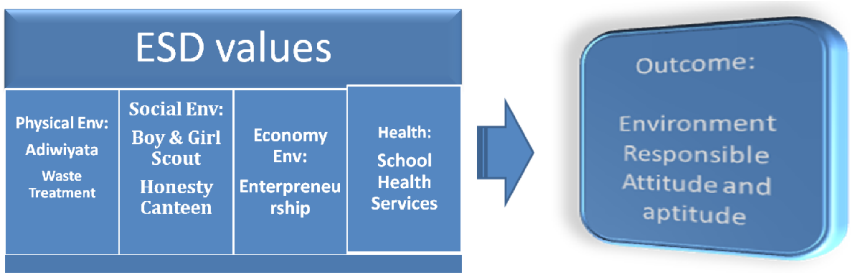
Participation in ESD International Workshops and Symposiums

- World Conference on ESD in Bonn, Germany on 31st March to 2nd April, 2009.
- Advanced International Training Program on ESD in Higher Education 2009 in Stockholm, Sweden on 27th April to 15th May, 2009.
- Asia Pacific Conference for ESD Educator and Facilitator in Tokyo, Japan, on 8th – 11th August 2009
- Advanced International Training Program on ESD in Higher Education 2009 (Asian Regional Forum) in Pathum Thani, Thailand, on 3rd – 14th August, 2009.
- International Conference on University – Community Engagement in Penang, Malaysia, in November 2009.

Lessons and Best Practices in Directorate General of Nonformal and Informal Education

Some programs related to ESD have been established, e.g. the Green School or Adiwiyata, School Health Services (Usaha Kesehatan Sekolah) in which the success of the programs are measured periodically among elementary and high schools. Another is the "Shadow Teacher" wherein parents are trained to be a "24 hour teacher" who are ready to advise them 24 hours a day, to build students' characters.

Scope of the program



Lessons and Best Practices Learnt by the Directorate General of Non-formal and Informal Education

Development of Vocational Village Based on Empowerment Paradigm and Enviromentally Friendly Approach in Gemawang Village, Jambu, Semarang, Central Jawa:

- Under this activity, communities have been trained to understand the true potential of the village, and have designed ESD-based business plans.
- The community is now running some small enterprises such as indigo dye productions, batik industry center, coffee industry, etc.

Development of Vocational Village Based on Empowerment Paradigm and Enviromentally Friendly Approach in Reksosari Village, Suruh, Semarang, Central Jawa:

- Under this activity, communities have been trained to understand villages' true potential, and have designed ESD-based business plans.
- The community is now running some small enterprises such as crystal sugar productions, rabbit husbandry, etc.

Lessons and Best Practices Learnt by the Directorate General of Higher Education

Community Based Landslide Early Warning System

Indonesia is located in the multi-disaster area; it especially experiences landslide disasters. UGM landslide researchers together with the SCS – CEL program have implemented Community Based Landslide Early Warning System in some places within Java Island since 2003 up to now.

The UGM landslide group has been a member of the International Consortium on Landslides Board of Representative since 2008. The program has helped to install early warning system equipments for landslides together with local people, and help train the community

to operate and maintain the equipment, to acknowledge the sound of alarm as well as to simulate landslide evacuation procedures.

Zero Waste Integrated Farming

Most people in a village named Banyakan, Piyungan, Bantul District, are cattle farmers who care simply for the cattle but take little notice of animal waste. In 2006, SCS-CEL students came to the village and introduced animal waste recycling method to produce biogas and bio-fertilizer. Previously, UGM researchers developed a simple, low-cost, and portable bio-digester which can convert animal waste into biogas and the rest becomes bio-fertilizer.

Based on this research results, the UGM through the SCS – CEL Program, planned to develop a community based self-sufficiency energy village by implementing the portable biogas digester. The resulting biogas is used as a daily energy source for cooking, and the fertilizer is used in their paddy fields.

Coastal Revegation in Kebumen District

Along the coastal area of Kebumen, Central Java, it was very wide but sandy and had no vegetation. This coastal area is now inhabited and very crowded, and as such has become highly vulnerable to tsunami events. Therefore, the area needs much vegetation to protect the inhabitants from tsunami and abrasion. Observation and research was conducted by UGM researchers to find out which plants can be suitably grown in the area. Stakeholders and participants involved in this program are: UGM's students and lecturers, the 4 village-communities, local government, Ministry of Forestry, Forestry Office of Kebumen District.

Clean Water Exploitation using Solar Energy in Gunung Kidul District

Gunungkidul is a district in Yogyakarta which consists of very dry areas with no consistent clean water supply. During the dry season, the only water resources are rainy and muddy water ponds that are used for washing, cooking, and drinking either by human and animals SCS – CEL students found a water supply problem in Giricahyo, Gunungkidul. To address this, they created focus groups for discussion. Discussion took a multidisciplinary approach and incorporated community-sharing. By having collaborated with the local community and local government, they decided to run a project to explore an underground river located 107 meters below surface. They subsequently enlarged the collaboration with the Center for Energy Studies of UGM, DGHE-Ministry of National Education, Ministry of Public Works and Water Supply Company, BPP Teknologi (Agency for the Assessment and Application of Technology), and States Bank Association.

Illiteracy Eradication Using Mother Tongue Languages

UGM proï¿½duced literacy modules using some local languages (Javanese, Sundanese, Bugise, and Maduranese) to accelerate the eradication of widespread illiteracy. The choice of the local languages applied in the modules was based on data that indicated those languages are being used by people living in areas with the highest illiteracy rates. The reason why these modules can accelerate the eradication program is because illiterate people are very poor, uneducated, and located in very remote areas, and do not speak Indonesian Bahasa. In fact the national modules provided for illiteracy eradication are in Indonesian, so that the program participants need at least six months to finish the program and obtain a literacy certificate.

ProSPER Net Program

ProSPER Net attempts to integrate ESD into all aspects of academic life at the Master of Business Administration Program Universitas Gadjah Mada. As an initial step, the project focuses on efforts to integrate ESD into the curricula. The project will involve a series of workshops, seminars, and training to develop curricula, syllabus, cases, handouts, and modules. Since the goal is to integrate ESD into all aspect of academic life of MM UGM, we also plan to adopt the concept of ESD in the building our new campus in Jakarta. This program will involve efforts to integrate ESD in the process of planning, designing, and building the new campus.

RCE, ESD and UGM

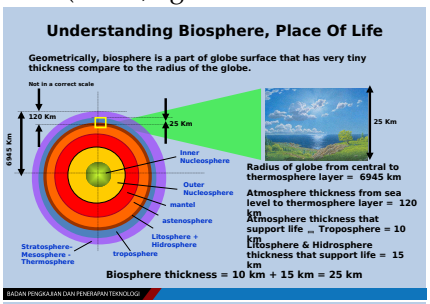
UGM is the proponent of Yogyakarta Regional Center for Expertise on the Education for Sustainable Development (EfSD). It received special acknowledgement from UNU Rector, August 31st, 2007. The main thematic focuses are:

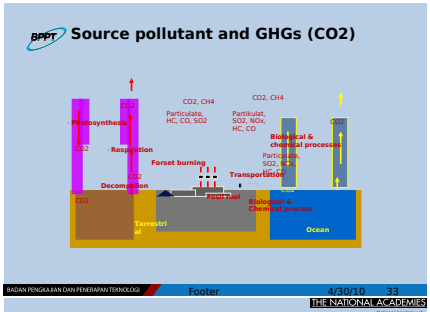
- Provision of basic education and access to (formal and informal) education system
- Promoting sustainable development of SME
- Incorporating global climate change education for local communities
- Mainstreaming disaster management into sustainable development practices
- Implemented by Student Community Services-Community Empowerment Learning (SCS-CEL)

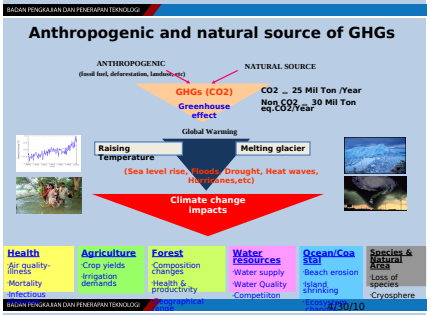
CLIMATE CHANGE ADAPTATION AND IMPACTS ON ECOSYSTEMS IN INDONESIA

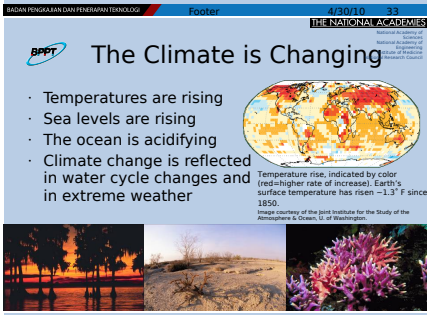
Prof. Kardono
Head of Centre for Environmental Technology, the Agency for the Assessment and Application Technology (BPPT)

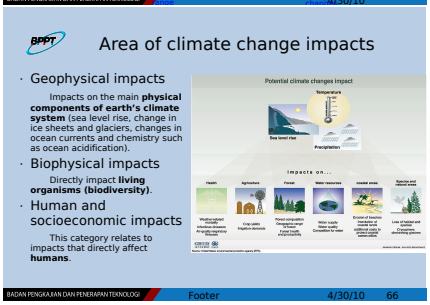
In his presentation, Prof. Dr. Kardono introduced the dynamics of the biosphere and the impacts of anthropogenic and natural sources of greenhouse gas emissions, focusing on the geophysical, biophysical, and human and socioeconomic impacts. He described in detail, the oceanic phenomena of Indonesian seas, the vulnerability of the Indonesian sea and coastal zone, and ocean and coastal biodiversity (marine plankton, seaweed, sea grass and coral reefs). He also talked about the agricultural and forest ecosystem in Indonesia, and outlined the National Plans, actions and technologies to improve the adaptive capacity of all three sectors (ocean, agricultural and forestry).

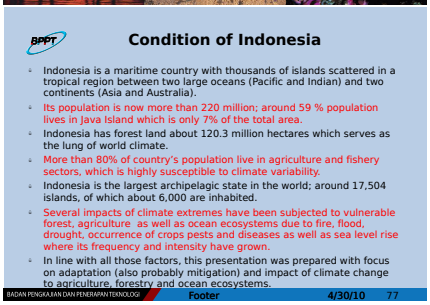










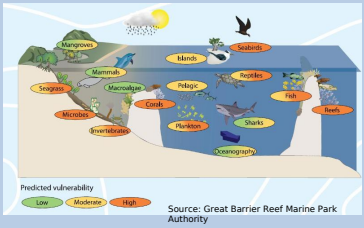


Necessary Work And Technology Needs For Climate Change Adaptation In Indonesia

Ecosystem or Sector:
- Ocean and Coastal
- Agriculture
- Forestry
- Health
- Infrastructure

OCEAN ECOSYSTEM

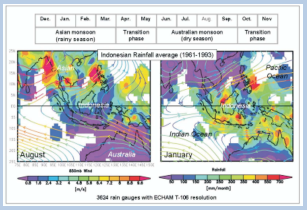
Vulnerability of marine ecosystem



Source: Great Barrier Reef Marine Park Authority

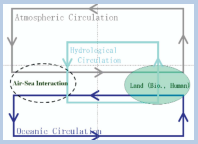
Oceanic Phenomena of Indonesian Seas

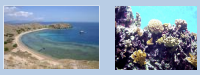
- Indonesian waters are characterized by an interaction of waters from the Pacific and the Indian Oceans.
- Sea-surface temperatures typically about 25° to 32°C, while the water temperature of the Pacific is higher than that of the Indian Ocean.
- The Indonesian archipelago is characterized by strong seasonal variations in the upper oceanic circulation, influenced by



Vulnerability of the Indonesian Sea and Coastal Zone

- Indonesian marine waters consist of various marine resources potential, e.g.; shipping, transportation, oil and gas production, fisheries, aquaculture, and tourism.
- One of the simplest interactions between ocean and atmosphere is the heating of the ocean surface which produces an upward air-mass movement that results in air circulation





Coastal Vulnerability of Indonesia

Vulnerability of the Indonesian Sea and Coastal Zone

- The climate change will impact upon the coastal and marine resources, particularly due to:
  - Sea-level rise
  - Change of sea surface temperature
  - Change of water acidity
  - Increase of the frequency and intensity of extreme events such as tropical storms and high waves.
- These impacts are
  - damage and loss of economic assets and infrastructure,
  - increase of erosion and damage to the fisheries and aqua-culture sites in coastal areas,
  - degrade coastal and marine bio-diversity,
  - Bleach coral and other habitat,
  - threat to low lying islands, including outer small islands, functioning as reference points for Indonesian territory.

Ocean Sector Adaptation

Related to climate change adaptation, the Indonesia national plan for the ocean sectors i.e.:

a. Fisheries sector to focus only on developing three main commodities: seaweed, tuna, and shrimp (revitalization of fisheries sector program)
b. International cooperation on combating IUU (Illegal, Unreported, Unregulated) Fishing, referred to Code of Conduct for Responsible Fisheries (CCRF) - FAO
c. Surveillance and control of marine eco-system degradation
d. Surveillance and control of coral utilization
e. Be members of the Regional Fisheries Management Organization (RFMO), such as IOTC (Indian Ocean Tuna Commission).

Ocean Sector Adaptation

Adaptation needs:
- Ocean Observing System & Modeling (sea level rise model)
- Seawall in coastal area
- Seawall by mangrove and coastal vegetation
- Coral reef rehabilitation
- Coastal area infrastructure: port facility
- Water conservation and management
- Marine fisheries: pattern change
- Fresh water resource and management

Adaptation Needs for infrastructure:
- Building and housing infrastructures
- Fresh water supply / water desalination plant
- Sanitation for small islands and beaches
- Airport and seaport
- Sea / river transportation
- Infrastructure planning of the coastal area

INDONESIAN OCEAN AND COASTAL BIODIVERSITY

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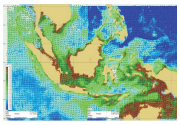
Marine Plankton

Ocean dynamics in Indonesia are observed within available technology as follows:

1. Satellite observation:
   - Sea surface conditions: temperature (SST), height anomaly (SSHA), current (SSC), ocean colour (OC), and salinity (in the near future)
   - Distribution and concentration of chlorophyll-a.
2. Coastal observations and in-situ measurements:
   - Monitoring through coastal stations: observation of tides, observation of water column in shallow water (CATS Coastal Acoustic Tomography System)
   - In-situ measurements: CTD, drifters, surface buoy, underwater moorings Remote-sensing technology has been used as a primary data source in national marine observation systems, considering its temporal and spatial scale capability to cover the entire Indonesian territory regularly. Space observations of Indonesian waters reveal that characteristics of the plankton distribution also contain variations due to seasonal change.

Marine Plankton

- Image of plankton distribution during May-June 2005 shows dominancy in Java and Arafura Sea, also in Makassar Strait. There are some numbers of high plankton concentration situated south of Bali Island and Nusa Tenggara (shown in green colour). The Pacific Ocean is shown to have low concentrations (blue colour). Brown indicates concentration of plankton with organic content from sediment.
- In general, Plankton distribution is dominant in several areas, such as the Malacca Straits, the Kalimantan waters, and Arafura Sea where almost the entire year shows high plankton concentrations.
- There are areas indicated with continuous plankton concentrations, due to the Indonesian through flow as shown in the Straits of Bali, Lombok, and Timor.



- Plankton concentration in Indonesian water varies from 0.01 mg/m3 to 1.8 mg/m3 and distribution is due specifically to several parameters that are interfering with each other, such as current, up-welling, sun radiation, etc.

Seaweed

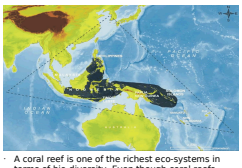
Potential areas for seaweed culture in Indonesia.

Based on ecological requirements for seaweed growth, the Indonesian coastal zone is suitable for seaweed culture development, with the potential of various species.

Seagrass

- The greatest sea grass species diversity in single-climate countries occurs in the tropics: the Philippines, Papua New Guinea, together with Indonesia are the center of global sea grass bio-diversity.
- Sea grasses cover at least 30,000 km2 throughout the Indonesian Archipelago, from Pulau Weh in Aceh to Merauke, Papua.
- The diversity of sea grass in Indonesia is among the highest in the world, and seven genera and 12 species of sea grasses currently occur in Indonesian waters (Green & Short, 2003).
- Worldwide, sea grass occupies about 600,000 km2 of the continental shelf, contributing 12% of the total carbon storage in the ocean (Duarte & Cebrian, 1996; UNEP, 2004).
- Sea grass eco-systems in carbonate sediment banks represent a natural sink for atmospheric CO2 – a shallow water "biological pump" – and may be responsible for as much as 10% of the ocean's annual net CO2 uptake (Dierssen & Zimmerman,2003).
- Seagrass meadows are sites of intense organic and inorganic carbon fluxes. Unfortunately, these fluxes are seldom examined in concert ,so that the carbon output of sea grass meadows, and their potential role as carbon sinks or sources, remains limited. (Barro et al, 2006).
- Further activities of the potential role of sea grasses in Indonesian marine waters as carbon sink, need to be examined.

Coral Reefs



- A coastal reef protects an island or main-land from the ravages of tides and waves.
- Coral reefs fringe the coasts of almost 100 countries in the world, covering some 600,000 km2.
- Indonesia has the highest diversity of coral reef and the largest world coverage of coral reef (approximately 75,000 km2), but only about 6.20% is still in good condition.
- Coral reefs in Indonesia spread from Aceh to Papua (see Figure showing the map of coral triangles in the world.

- A coral reef is one of the richest eco-systems in terms of bio-diversity. Even though coral reefs looks massive and strong, they are, in fact, fragile to environmental changes.
- Some of coral associated sponge species are known to produce bio-active substances having a high potency to be further developed for cancer treatment. Similarly, the carbonate skeleton of a coral colony has been used in osteotherapy.

AGRICULTURE ECOSYSTEM

Impacts in agriculture in sub-tropical region

Agricultural Impacts

- Difficult to pinpoint climate impacts: climate change occurring along with improvements in farming techniques
- In general, plants may:
  - Grow faster (increasing yields unless it becomes too warm or crops mature too early)
  - Be affected by carbon dioxide levels (increased growth for some plants, not for others)
- Good information about changes and adaptive practices is essential for farmers

Climate Change Impact and Adaption on Agriculture

Climate change impacts on agriculture in tropical region due to:

- Extreme climate
- Change water rainfall pattern:
  - flood, water run-off, landslide
  - drought
- Plant Diseases

→ declining productivity

Climate Change Adaption for Agriculture

- Climate prediction and modeling
- Introducing crops varieties tolerance to drought and flood (submergence), pests and diseases.
- Cropping calendar & pattern
- Early mature crops varieties
- Water harvesting and conservation

  Efforts to provide more water, such as:
  - a water harvesting system using channel reservoirs and mini water-pond,
  - combined with efficient water use through applied irrigation.
  - rain (weather) modification
- Efficiency water irrigation management, such as intermittent irrigation for rice field
- Downstream agricultural areas, especially in coastal regions need to be protected from coastal flood hazards, such as through the introduction of a reservoir channel.

Adaptation Activities for agriculture sector

- Arrangement of crop timetables combined with the prediction of the favorable time for planting and amount of water available.
- Climate prediction needs to be established to anticipate the future climate condition.
- Develop weather-station networks outside Java and concurrently to maintain the stations in Java.
- Secure food through: (a) integrated crop management, and (b) water resources management.
- Priority of technologies for integrated crops management are: (a) appropriate cropping calendar, (b) introducing crops varieties tolerant to drought and flood and early mature crop varieties as well as dry seedling technology.
- Priority of water resources management technologies are: (a) water conservation technology, (b) water harvesting technology, (c) technology of modification of micro climate, (d) technology of efficient water use, and (d) intermittent irrigation for rice field.
- Micro-climate modification needs technologies of crops diversification.
- An integration of water harvesting and irrigation application.

Technologies priority of Agriculture sector for adaptation to climate change

Agriculture sub-sector	Climate Prediction	Adaptation Technology
Rice field/ Horticulture	a. Climate database Management b. Climate information technology c. Climate model development	a. Crops tolerant to drought and flood b. Early mature crops varieties c. Cropping calendar d. Water harvesting e. Efficient irrigation
Perennial crops	a. Climate database Management b. Climate information technology c. Climate model development	a. Introducing estate crops varieties tolerant to drought and flood b. Appropriate Crop sheltering c. Correct planting distance d. Optimum crops density
Livestock	a. Climate database Management b. Climate information technology c. Climate model information	a. Adaptable cattle to dry and wet climate b. Communal livestock sheltering
Peat Land	a. Climate database Management b. Climate information	a. Minimum tillage b. Balance fertilizing c. Appropriate soil amelioration d. Drainage control

FOREST ECOSYSTEM

Forest In Indonesia

- Forests occupy major portions of land mass in different countries.
- In Indonesia forests occupy 60% of the land mass
- Forests have many functions:
  - Provides habitat for plants and animals
  - Influence amount of and availability of water runoff
  - Provide sites for recreation
  - Provide timber for harvesting lumber; wood pulp, fire wood for fuel

57. 53 M ha (47 %)

Source : Forest Planning Agency, MoF (2006)

National Plan

Indonesia has implemented five priority policies since 2000, as follows:

1. Combating illegal logging and forest fires
2. Restructuring forestry-sector industries, including the enhancement of plantation development
3. Forest rehabilitation and conservation
4. Securing forest land : strengthening the legal status of state forest land
5. Strengthening the economy of local communities

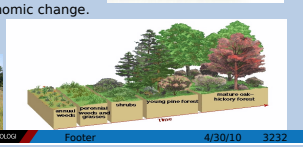
Through the five priority policies, the government of Indonesia has set up targets as the following:

1. Combating illegal logging : law enforcement, through an inter-sectoral approach
2. Forest & land rehabilitation : 5 million ha between 2003-2009) and forest conservation (institutional strengthening in protected-area management)
3. Forestry sector restructuring through enhancement of timber plantation and industry restructuring : HTI 9 million ha by 2014 using genetically improved seeds and improved production of forest management
4. Strengthening the economy of local communities : community forest (HTR 5.4 million ha by 2014, HR 8 million ha by 2025)

Climate Change Impact on Forestry

Climate change impacts:

- Forest processes,
- Biodiversity change,
- Disturbance interactions, and
- Socioeconomic change.



Adaptation of Forestry on Climate Change

- Silvicultural technology: seed technology, land preparation, planting and tree improvement to increase productivity and quality of forests, as well as tolerance to drought.
- Growth and yield modeling technology.
- Maintenance (fertilizing and weeding, and spacing).
- Growth and yield modeling (forest inventory; yield regulation / allowable cut and rotation).
- Genetic improvement, especially to increase productivity and quality of timber.
- Site species matching to give a good effect on survival rate and growth of plantation
- Technology in forest protection (from pest, disease, weed and fire).
- Zero burning technology.
- Carbon accounting: more advance and cost effective technology than the current available technology.
- Measurement of carbon sequestration

Prioritized technology for mitigation and adaption in forestry sector

No.	Program/ activities	Selected technology
Carbon Sequestration		
1a	Industrial Forest plantation (HTI)	Silvicultural technology,
		Growth and yield modeling technology
		Advanced Tree improvement
		Pest, disease, weed and fire management
1b	Small scale forest plantation (HTR, HR)	Silvicultural technology,
		Site species matching
		Pest, disease, weed and fire management
1c	Rehabilitation/ restoration	Site species matching
1d	1a, 1b, 1c	Carbon related measurement and monitoring for carbon sequestration activities
Emission reduction		
2a	Management improvement of natural forests	Reduced Impact Logging in production forest
2b	Curbing Illegal Logging	Use of Molecular Biology to support chain of custody (e.g. DNA analysis for log tracking)
2c	Forest fire prevention and control	Zero burning technology
2d	2a, 2b, 2c	Carbon related measurement and monitoring for reduced emission activities

CLIMATE CHANGE AND TROPICAL DISEASES: STRATEGIES FOR IMPROVING COMMUNITY RESILIENCE

Prof. Dr. Hari Kusnanto
Center for Environmental Studies Gadjah Mada University, Bulaksumur, Yogyokarta 55281, Indonesia

Over the next few years billions of people in developing countries will face shortages of safe water and food, and greater risks to health and life as a consequence of climate change. Combustion of fossil fuels and deforestation have caused accumulation of atmospheric carbon dioxide (CO_2), methane (CH_4), nitrogen dioxide(N_2O) and other greenhouse gases. Warming of the climate system is now beyond any doubt. The average global surface temperature is approximately 0.8^{0}C above its level in 1750. The most rapid increase in global temperature has been occurring since 1970. Manifestations of climate change include alterations in cloud cover and precipitation, melting of ice caps and glaciers, and increases in ocean temperatures and acidity (due to carbon dioxide absorption from the atmosphere). Rainfall patterns have changed, and sea levels have risen. Tropical cyclones have become more common.[1][2]

There are few resources available for adaptation to climate change in developing countries, which make people in these countries more vulnerable to climate change impacts. Indonesia, an archipelago, is at high risk for heavy rainfall and floods. Agriculture, fisheries and forestry are threatened, which greatly decrease food security. Increased sea level will threaten coastal livelihoods, undernutrition and diarrheal diseases will be more widespread and life expectancy will be reduced as global warming continues unabated.

Climate change will have wide ranging impacts on human health. The more direct type of health impacts would include those caused by changes in the seasonal weather extremes, such as cardiovascular and respiratory diseases related to air pollution, and heat exhaustion. Indirect effects of extreme temperatures are related to their impacts on air pollution and humidity, which may aggravate pre-existing illnesses.[3]

Many infectious diseases in the tropic are transmitted by vectors, such as mosquitoes, flies, ticks, fleas and rodents, and the fluctuations in temperature and rainfall that went along with El Nino events have coincided with outbreaks of vector-borne diseases, such as malaria and dengue. In Indonesia, climatic events were also associated with an increase in respiratory illnesses.[4]

The potential increase of vector-borne diseases would mostly be in tropical and subtropical regions. Temperature, rainfall and humidity

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affect breeding and survival of mosquitoes, such as Anopheles and Aedes, and the development of malaria parasites and dengue virus in the respective mosquitoes. Temperature is a major determinant of malaria transmission.[5] Over the last 40 years, malaria has been spreading to highland areas of East Africa, Indonesia, Afghanistan and elsewhere, partly due to increasing trend of the average temperature, although other factors, such as migration and land use patterns,[6] drug resistance of malaria parasites and weakened vector control effort[7] should be taken into account.

Despite evidence that climate change is likely to increase the area of land with a climate suitable for dengue fever transmission[8], there are reservations about predicting future effects of climate change on the incidence of dengue fever.[9] Heterogeneity in local dengue transmission pattern is associated with local and temporal climatic characteristics.[10] Mathematical models used in predicting dengue activity with climate change have to incorporate local vector and virus data.[11] Climate variability was partly responsible for transmission intensity of dengue in Singapore; however, surveillance systems and vector control were important factors in averting the upsurge of dengue incidence.[12] When efforts for vector control are limited, climatic events such as El Nino cause dengue outbreaks, as shown from the reported cases of dengue hemorrhagic fever in Indonesia from 1968 to 2006 (figure 8.1).

Distribution of insecticide-treated bed nets (ITNs) in Vanuatu reduced fluctuations of malaria transmission associated with climate variability.[13] Dengue is an urban and periurban disease caused by circulating dengue virus, transmitted mainly by Aedes aegypti which breed in container habitats, such as water tanks, tires, buckets, plastic bottles and vases. Community awareness and participation in the elimination of breeding sites of dengue vectors should mitigate the impact of climate variability on dengue incidence.

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10 Johansson MA, Dominici F, Glass GE. 2009. Local and Global Effects of Climate on Dengue Transmission in Puerto Rico. PLoS Negl Trop Dis 3: e382. doi:10.1371/journal.pntd.0000382

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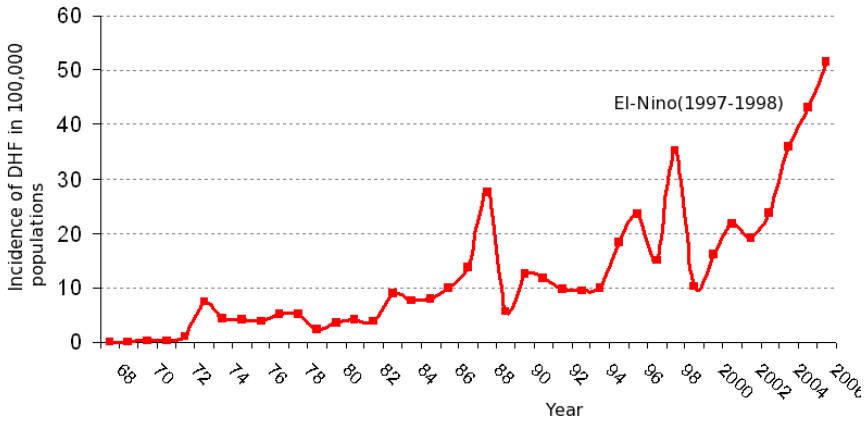

Figure 8.1: Annual reported incidence of DHF in Indonesia

Public health perspectives to protect the communities from the health effects of climate change include primary prevention, which corresponds to mitigation (especially efforts to reduce green-house gas emissions) and adaptation to anticipate and prepare for climate-induced diseases and illnesses.[14] Many of the mitigation and adaptation efforts are deeply rooted in general social development and poverty alleviation. To improve community resilience against hunger and malnutrition associated with climate-induced food insecurity, education and empowerment of the communities are critical so that food utilization (enhanced nutrition value, social value and food safety) could be optimal, while investment in society should be focused on food availability and food access.[15]

Climate vulnerability is caused by unsustainable patterns of development and socioeconomic inequity, which are still ongoing, despite world-wide efforts to curb them. Adaptation is not an alternative to mitigation of climate change or an ethical compromise to dangerous behavior related to green-house gas emissions.[16] Community-based surveillance systems and preparedness against currently prevalent tropical diseases (such as malaria, dengue, chikungunya, leptospirosis) should consider that the impacts of climate change will vary from one part of a region to another, and non-climatic factors cannot be put aside when planning for disease prevention and control.

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9

THEMATIC SESSION 3

REGIONAL INTEGRATED MULTI-HAZARD EARLY WARNING SYSTEM (RIMES) FOR AFRICA AND ASIA

U. C. Mohanty
Centre for Atmospheric Sciences, IIT Delhi, New Delhi, India. ucmohanty@gmail.com
K V J Potty, PVS Raju and A. Subbiah RIMES, AIT Campus, Bangkok, Thailand

Abstract

Vulnerability to hydro-meteorological hazards (e.g. tropical cyclones, thunderstorms, heavy rainfall etc.) and tsunamis is becoming more pronounced because the fastest population growth is in tropical (coastal) regions. Therefore, The countries in and around South East Asia and the Indian Ocean began a regional cooperation for the establishment of Regional Integrated Multi-Hazard Early Warning System (RIMES) to mandate for providing early warning services of tsunami and hydro-meteorological hazards and the capacity building of its member countries. Global models have been successful in predicting the large scale systems while they are still ineffective for small/cloud scale systems which require high resolution meso-scale models. Hence, an operational unit of RIMES has adapted state-of-the-art high resolution meso-scale model WRF-ARW (Advanced Weather Research and Forecasting) model developed at NCAR with grid resolution of 9 km. Since, 1st July 2008, RIMES have been continuously providing real-time forecasts of the above mentioned hydro-meteorological hazards to various member countries based on specific requests. The salient features of the modeling system is discussed and demonstrated with real time simulations. It is also depicted how this modeling system can be used for the generation of early warning information for severe weather events such as tropical cyclones, thunderstorms and heavy rainfall events etc. RIMES have forecasted successfully the 2008-09 tropical cyclones over the Bay of Bengal. Under the pilot phase of STORM (Severe Thunderstorm Observations and Regional Modeling) project, RIMES has also simulated the thunderstorms that happened over many parts of India and Bangladesh within a 3 km resolution. In this presentation, a brief institutional framework of RIMES and its collaboration with member countries are discussed. RIMES activity on hydro meteorological components and future plans are also presented.

MYCLIMATE -MOBILIZING STAKEHOLDERS IN ADDRESSING CLIMATE CHANGE

Joy Jacqueline Pereira & Mazlin Mokhtar
Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia

Malaysia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1994 and the Kyoto Protocol in 2002. The National Focal Point for the country is the Ministry of Natural Resources and Environment Malaysia. The Ministry also hosts the National Steering Committee on Climate Change and coordinates the necessary follow-up with respect to the Convention. The effort to address climate change in the country necessitates a collective effort from various stakeholders including the federal, state and local governments, community based organisations, non-government and community-based organisations, academia and the private sector. It was in this context that the Ministry supported the establishment of the Malaysian Network for Research on Climate, Environment and Development (MyCLIMATE) to serve as a platform for various stakeholders to interact, hosted by the Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia. MyCLIMATE is a network of researchers and practitioners from various universities, government agencies and organisations that conduct activities to address climate change in support of sustainable development. The main objective of MyCLIMATE is to provide a platform for researchers from various disciplines to interact with each other and engage policy-makers and practitioners involved in climate, environment and development. MyCLIMATE also promotes policy-relevant research and capacity building in addressing climate related issues. On the international front, MyCLIMATE cultivates linkages for supporting the country in planning, coordinating and implementing climate change and related agreements.

MyCLIMATE provides research support to the National Focal Point of Malaysia to the UNFCCC as well as government agencies at the federal, state and local levels. An outcome of MyCLIMATE is the National Policy on Climate Change, which was approved by the Malaysian Cabinet on 20 November 2009. The year 2010 will see MyCLIMATE embark on two major stock-taking exercises of activities on climate change adaptation to get an idea of who is doing what, so that proposed activities are consolidated and streamlined to avoid replication. The first activity is related to research. A workshop is being planned to advance research on climate change and biodiversity in the country. The workshop will see participation from researchers within universities and government agencies; and ongoing work in the Second National Communication of the country to the UNFCCC will be used as a point of departure for this purpose. The second activity is related to education and raising awareness on climate change. A workshop has been proposed involving non-government organizations, to identify specific target groups and understanding of their needs with respect to awareness and ca-

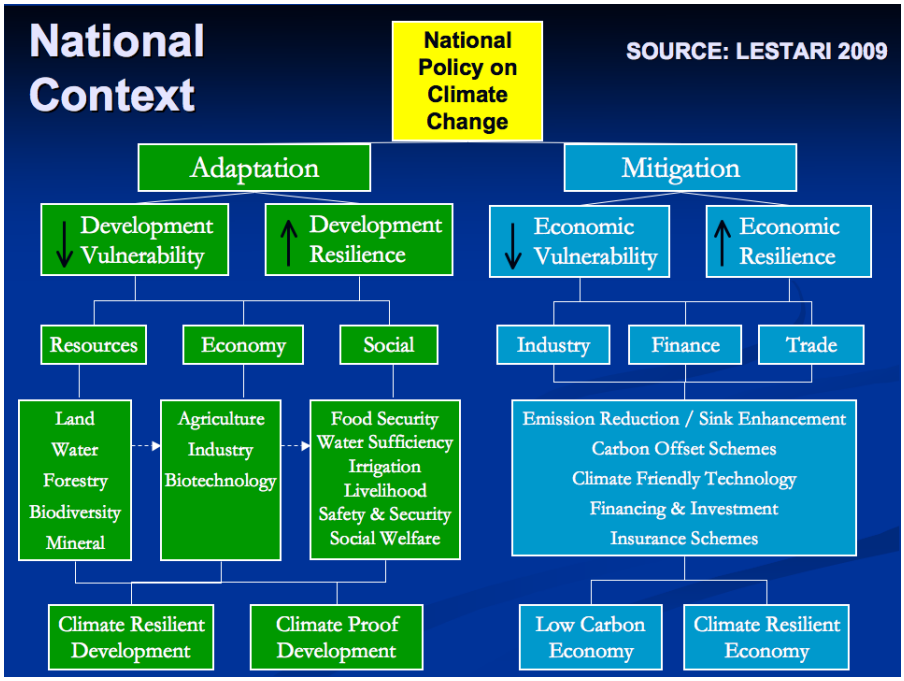


Figure 9.1: MyClimate: National Context

pacity building on climate change adaptation including disaster risk reduction. This will be followed by preparation of awareness raising products for specific target groups in conjunction with partner organizations. In addition, MyCLIMATE is also undertaking a Country Assessment of Higher Education Needs for Climate Ecosystem Change and Adaptation to support LESTARI as a participating institution of the University Network for Climate and Ecosystem Change Adaptation Research (UN-CECAR).

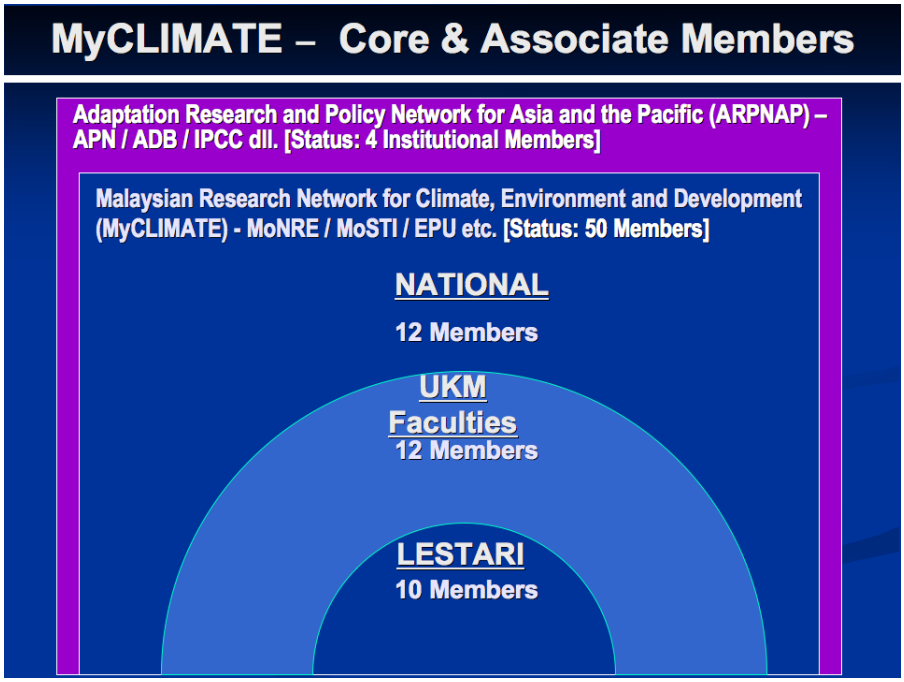


Figure 9.2: MyClimate: Core and Associate Members

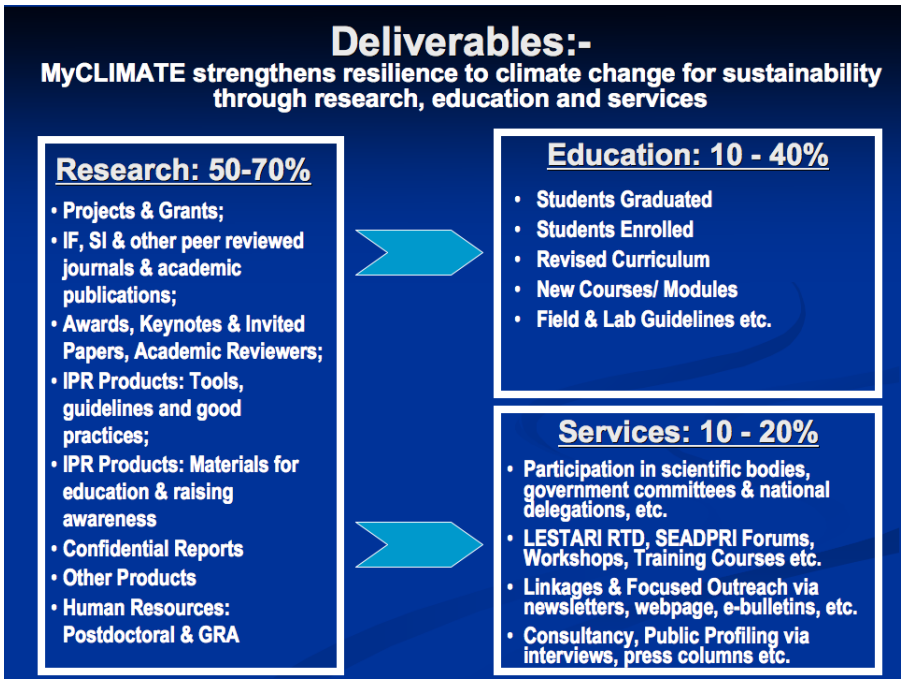


Figure 9.3: MyClimate: Deliverables

Figure 9.4: MyClimate: Research Areas

10

INTERFACE SESSION

UN-CECAR: A UNIVERSITY NETWORK TO ADDRESS ADAPTATION

Dr. Srikantha Herath
Senior Academic Programme Officer, UNU-ISP

Introduction

Dealing with climate change is the most important challenge the world is facing today. The evidence compiled by the United Nations Intergovernmental Panel on Climate Change (IPCC) shows clearly that anthropogenic activities are responsible for the high levels of green house gases in the atmosphere that are warming our planet to unprecedented levels. If present trends continue, the global energy and water cycles could well be drastically altered. This would make our climate and weather patterns unable to support the life styles we now take for granted. This poses an unprecedented multidimensional challenge for all countries and communities in the Asia Pacific region. Home to a variety of geography, topography, biodiversity and climate, as well as systems of social governance and economies, the region will be affected by climate and ecosystems change in many different ways.

Changes are already occurring in both the climate and ecosystems. Local communities have begun to observe shifts in seasons and rainfall patterns for instance, causing irregular harvests. Actions such as altering planting and harvesting times are one of many responses communities have taken. But under high uncertainty, where past information may no longer be viable for future prediction and with limited resources, knowledge and capacity, what can communities do to adapt in the medium to long term? Generating new and alternative knowledge and practices is necessary to adapt successfully to climate change challenges.

Adaptation was identified as one of the five key building blocks required for a sustained future response to climate change during the thirteenth session of the Conference of Parties (COP13) in Bali. In COP14 in Poznan, the needs for successful adaptation were discussed at length. During the discussion, it was agreed that the actions required to adapt was not so different from development planning. The interconnection between economic growth and resilience to climate shocks means adaptation should be placed as a high policy priority. However with limited resources, the only pragmatic way for most vulnerable and developing countries is to approach adaptation by incorporating climate change resilience into development planning.

An important point to note about adaptation to climate change is that it is a local phenomenon. It depends on the local hydro-meteorological, bio-physical and socio-economic conditions. Solutions, therefore, have

to be developed locally, supported by global knowledge and experiences. Top-down approaches that assume adaptation will occur without addressing how it is to be achieved, are bound to fail as expressed by many practitioners, researchers and NGOs. For this, we need to develop local capacity. This can be done through higher education which is a key provider of climate knowledge for society. It is where the necessary research can be conducted through applied research projects in partnership with development agencies and local communities. Higher educational institutions in the Asia Pacific can be at the forefront of world-class research on climate change adaptation. However, wide disparities exist within the region as well as within countries. There are significant variations in the level and type of research knowledge, financial and technological resources available among institutions; with a tendency for research and educational programs to be scattered across separate programs and locations. There is a need to coordinate and optimize resource use across the region.

The IPCC Working Group II (2007) identifies the following key priorities to be addressed in order to narrow gaps between current knowledge and practice on the ground and policymaking needs:

- Quantitative assessment of the sensitivity, adaptive capacity, and vulnerability of natural and human systems to climate change, particularly changes in the range of climatic variation and the frequency and severity of extreme climate events.
- Assessment of possible thresholds at which strongly discontinuous responses to projected climate change and other stimuli would be triggered.
- Understanding dynamic responses of ecosystems to multiple stresses, including climate change, at global, regional, and finer scales.
- Development of approaches to adaptation responses, estimation of the effectiveness and costs of adaptation options, and identification of differences in opportunities for and obstacles to adaptation in different regions, nations, and populations.
- Assessment of potential impacts of the full range of projected climate changes, particularly for non-market goods and services, in multiple metrics and with consistent treatment of uncertainties, including but not limited to numbers of people affected, land area affected, numbers of species at risk, monetary value of impact, and implications in these regards of different stabilization levels and other policy scenarios.
- Improving tools for integrated assessment, including risk assessment, to investigate interactions between components of natural and human systems and the consequences of different policy decisions.

- Assessment of opportunities to include scientific information on impacts, vulnerability, and adaptation in decision making processes, risk management, and sustainable development initiatives.
- Improvement of systems and methods for long-term monitoring and understanding the consequences of climate change and other stresses on human and natural systems.

Source: IPCC Working Group II (2007)

Higher education should give direction and leadership in addressing the key priorities identified by the IPCC Working Group II (2007). It should help in establishing effective frameworks where affected communities can work with specialists in planning appropriate strategies.

Development of regional educational programs geared towards meeting local needs, anticipating future demands of various sectors, and that 'speed-up' climate knowledge is now timely, particularly with the recent mobilization of international support for adaptation. At the recent fifteenth session of the Conference of Parties (COP15), Copenhagen, December 2009, there was much attention on how to allocate funding for vulnerable countries to take action against climate change. Paragraph 3 of the draft decision to the Copenhagen Accord states "adaptation to the adverse effects of climate change and the potential impacts of response measures is a challenge faced by all countries. Enhanced action and international cooperation on adaptation is urgently required to ensure the implementation of the Convention by enabling and supporting the implementation of adaptation actions aimed at reducing vulnerability and building resilience in developing countries, especially in those that are particularly vulnerable, especially least developed countries, small island developing States and Africa. We agree that developed countries shall provide adequate, predictable and sustainable financial resources, technology and capacity-building to support the implementation of adaptation action in developing countries."

Finally, the focus on adaptation should also go beyond climate change concerns. Essentially, the climate crisis is a crisis of sustainability. In such dynamic systems as our Earth, sustainability can only be achieved by adapting to the levels of currently available resources and services. Therefore, adaptation becomes a pre-requisite for sustainability. We must design innovative development strategies that are climate change resilient and at the same time flexible enough, so that we can 'adapt' not only to climate change, but also to other future 'global changes'

Developing localized knowledge for adaptation and linking it to the sustainability science approach are the central focus of the University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR) that was established in 2009 June as a result of a consultation conference held in Tokyo, Japan. How we improve collaboration and share resources is another critical issue that UN-CECAR is seeking to address.

Figure 10.1: UN-CECAR conference proceedings

10.1 UN-CECAR ACTIVITIES

The present conference in Yogyakarta is the 3rd conference in Asia and the forth in CECAR series. During each of these meetings, deliberations the issues of managing UN-CECAR network and implementing its activities were discussed at length. The details of the presentations and deliberations are given in the proceedings shown in Figure 10.1, which are available free of charge at UNU-ISP.

During these deliberations, the following decisions have been taken.

1. UN-CECAR will be open to membership for Universities with post graduate programs currently working on climate and ecosystems change.

2. UN-CECAR will be managed by an International Coordinating Committee of the founding universities.

3. UN-CECAR will invite Advisory Members (Specialists, research institutions, international organizations, etc.) to guide and support its activities.

4. Two working groups are established for (a) Curriculum Development and (b) Research program Development

5. Members will contribute to the development of educational materials and the products will be available for use by all

6. UN-CECAR activities will be facilitated by (a) a Repository of materials (b) Database (c) Portal (d) Video conferences and (e) Annual meetings.

During the deliberations and surveys, the following areas have been identified as priority focus areas to assess impacts of climate change;

- Land cover Water resources
- Agriculture
- Economy
- Health
- Migration
- Endangered species
- Protected areas

In order to mitigate adverse impacts, UN-CECAR will focus on

1. Seasonal forecasts
2. Improve governance
3. Use indigenous knowledge
4. Protecting, recovering livelihoods

Based on these needs, UN-CECAR deliberated on implementing a short term action program. Based on these deliberations, the sectretariat has designed 10 studies with basic funding to carry out the following tasks.

1. On Curriculum Development: to design outlines for 6 courses in each of the following category with 2 of them having detailed teaching materials
    a) Climate Change: Science and technology
    b) Impacts and Vulnerability
    c) Adaptation and Mitigation
2. On Collaborative Research to develop research program outlines for
    a) Rapid on set events: Extreme rainfall related
    b) Slow on set events: Land degradation and bio diversity conservation
3. To carry out needs assessment in
    a) China
    b) Nepal
    c) Malaysia

d) Sri Lanka

During the workshop that follows this conference, current status of these studies will be discussed and the next steps will be decided to use these outputs.

10.2 UN-CECAR FUTURE DIRECTIONS

UN-CECAR would like to develop post graduate programs across universities to be a repository of research results of cutting edge research programs and studies related to climate and ecosystems change that are currently taking place in the region. The post graduate programs can absorb and synthesize this knowledge,test research programs and outcomes for local conditions and provide feed back on the improvements. The research also would lead to improve and update tools and methodologies that would be made available to researchers and practitioners in the form of national and international training programs. Following the model adopted in the University of Gadjah Madah (UGM), these results would be guided to reach local communities in an appropriate manner. This concept is outlined in the Figure 10.2.

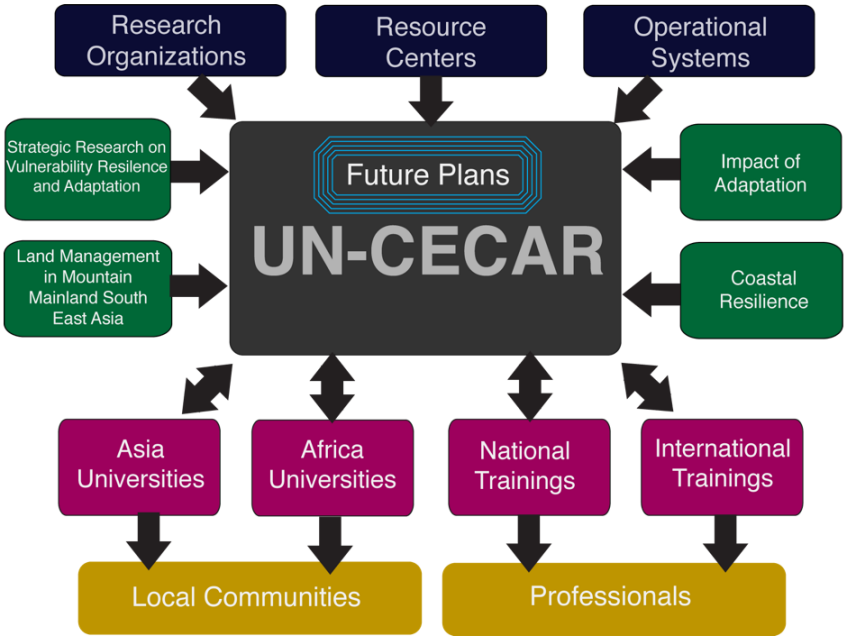
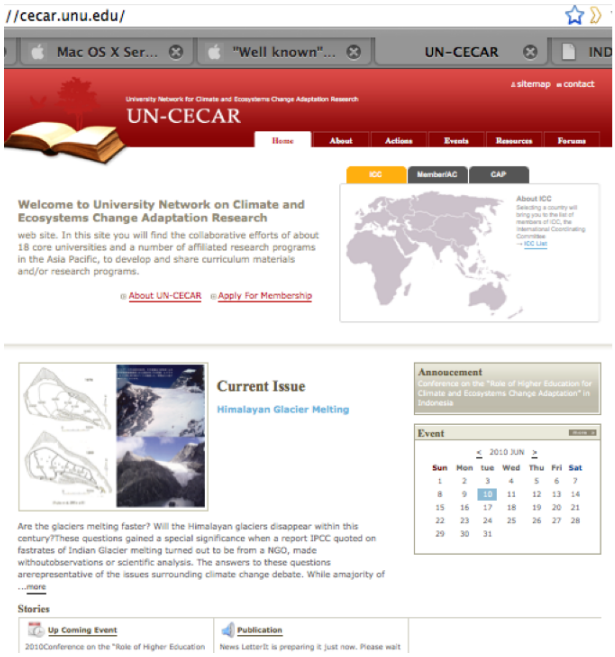


Figure 10.2: UN-CECAR Framework

The details of curriculum and research development as well as activities related to UN-CECAR will be made available in the CECAR website at http://cecar.unu.edu shown in the beta release in Figure 10.3



cecar.unu.edu

System consist of 8 wikis 8 blogs, Each wiki and blog can be edited by users

Return

Figure 10.3: UN-CECAR Website

LINKING HIGHER EDUCATION WITH RESEARCH AND COMMUNITY ACTIVITIES

Prof. Nobuo Mimura
Director, Institute for Global Change Adaptation (ICAS) Ibaraki University

Introduction

It is becoming more and more apparent that higher education will play an important role to build capacities for climate and ecosystem change adaptation in the developing countries in the Asia and Pacific region. We can identify three key areas in this education. They are:

1. Structuring climate and ecosystem change issue
2. Role of researches in the higher education
3. Expected adaptive capacity and education for them

In this paper, I will discuss the relevant issues to link higher education with research and capacity building.

Structuring Climate and Ecosystem Change Issue

As the global change issues are mutually related in a complicated manner, there are two large questions to develop the curriculum for the adaptation education; one is how to incubate a holistic view that needs to put the climate and ecosystem change in the global sustainability issues, and the other is how to structure the knowledge related to the climate and ecosystem change. In this section, we will see an attempt for structuring knowledge in the climate change field, which is shown in figure 10.4 schematically.

Figure 10.4 suggests that climate change issue consist of the following seven steps (Hiramatsu et al., 2010).

1. GHG emission from socioeconomic activities
2. Concentration of GHGs in the atmosphere through material circulation cycles
3. Climate change due to accumulation of GHGs in the atmosphere
4. Impacts of climate change on natural environment and human society
5. Adaptation to the adverse effects
6. Mitigation for reducing GHG emissions
7. Transformation of socioeconomic systems for emission reduction

The seventh step is then connected to the first one, indicating that the emission structure of the society will subsequently change. This is a

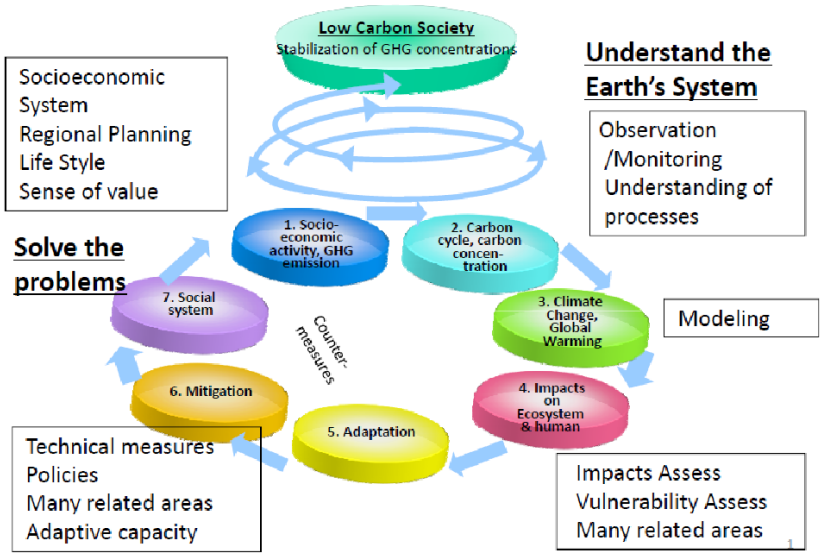


Figure 10.4: Structure of climate change processes (After Hiramatsu et al., 2008)

spiral process and by going through such spirals, global society will move toward a low-carbon society. Though adaptation education covers mainly step 3 to the step 6, the education also has to provide the holistic knowledge of the whole process of this spiral.

We can identify the scientific knowledge involved in each step of the spiral, as shown in boxes in figure 10.4. Scientific knowledge related to the step 2 to 3 is that for "understanding the earth's system", while the latter steps need knowledge for "solving problems". Though adaptation science for climate and ecosystem change is solution-oriented, obviously we need sciences for "understanding the earth's system" as well.

Role of Research in Higher Education

It is always emphasized that a close collaboration of higher education and research is important. By attending researches, students can understand the problem deeper and grow their capacity to solve the problems. As a holistic and structured view is important in the adaptation education as mentioned above, research project which they attend should pursue solutions for adaptation in a systematic way. Recently, many countries have developed such research programs and projects, and therefore the opportunity for students to participate in them is increasing. An example of such research projects is Strategic Research S-4 "Comprehensive Assessment of Climate Change Impacts to Determine the Dangerous Level of Global Warming and Appropriate Stabilization Target of Atmospheric GHG Concentration" funded by Ministry of the Environment, Japan.

Expected Adaptive Capacity and Education for Them - Ibaraki University's Graduate Program on Sustainability Science

1. Expected Adaptive Capacity

   Obviously many scientific capacities are necessary to promote the society's ability to cope with such changes. However, the following capacities might be major targets for the adaptation education, because they are

   a) Capacity for policy development
   b) Capacity for adaptation technology development
   c) Community's capacity for adaptation

   One serious question may be that capacities expected to experts in the areas of climate change and ecosystem adaptation, such as decision-makers in the environment ministry or planners in UN organization should be different those for experts in other areas. However, even if majority of the students will enter other areas, they have to bear scientific knowledge on the adaptation to environmental changes. Such consideration leads us to a concept that the educational programs of the higher education can be set separately for two different experts, i.e. direct and indirect experts for adaptation. In the next section, I will introduce a newly established program in Ibaraki University as an example for the program as common basis for sustainability science.

2. Graduate Program on Sustainability Science Ibaraki University

   Ibaraki University launched its Graduate Program on Sustainability Science (GPSS) in April 2009. Figure 10.5 shows an outline of this education program. An interdisciplinary program, it is designed for postgraduates and is composed of the Sustainability Science Course and the Sustainability Science Program. The Sustainability Science Course is one of the regular master's courses of the Urban System Planning Course of the Graduate School of Science and Engineering. The Sustainability Science Program is composed of minor courses offered by all graduate schools of Ibaraki University (Humanities, Education, Science and Engineering, and Agriculture).

   These courses aim to develop not only advanced expertise but also the following three different competencies. The first competency is holistic knowledge of the broad range of issues associated with sustainability science, so as to enable students to adopt different viewpoints as well as position their own expertise in various fields. The second is the development of communication skills to enable students to understand others and form relationships, collaborating skills to encourage various stakeholders to address issues, and problem-solving skills to identify real issues and resolve conflicts. The third is "mind" or "heart," which includes the motivation to dedicate oneself to the public, having one's own

beliefs to maintain that motivation, and synchronic/diachronic consciousness.

This education model can be referred to as "Education across Mind-Skill-Knowledge" (Shin-Gi-Chi in Japanese). This is an analogy derived from a proverb about traditional Japanese sports that defines Shin-Gi-Tai as the three elements essential to being a great athlete. Shin-Gi-Tai expresses the need in competitive sports for a comprehensive foundation combining physical ability (Tai = body), sophisticated athletic skills (Gi = skill) and sound mind (Shin = mind). The replacement of Tai with Chi (knowledge) yields the expression Shin-Gi-Chi: "Mind-Skill-Knowledge."

In order to achieve this objective, the curriculum is composed of three main categories (figure 10.5). First, Basic Subjects for holistic knowledge aim to help students understand the structures of the global system, social system, and human system, and consider the interactions among these systems from an integrated viewpoint. Second, Practical Subjects aim to nurture the skills and mind needed to work in international or domestic fields where students will experience complex problems, and must communicate and work with people living with those problems. Lastly, Specialized Subjects are offered with the expectation that recipients of sustainability education need expertise in a real field of specialization to which they can commit themselves.

The Practical Subjects in particular are one of the essential components of the education program. In 2009, the program initiated an international fieldwork seminar (Fieldwork in Sustainability) at Mai Khao village in Phuket, Thailand. To operate this fieldwork program cooperatively, Ibaraki University established an Academic Exchange Agreement with Phuket Rajabhat University in 2008. Additionally, a domestic fieldwork seminar deals with issues in Oarai City, in Ibaraki Prefecture.

Table 10.1 illustrates the difference between the Sustainability Science Course and the Sustainability Science Program. In the case of the Sustainability Science Course, subjects are included in the regular curriculum (a total of 30 credits must include 6 credits from Basic Subjects and 2 credits from Practical Subjects), and students earning the required units of credit will receive a Certificate of the Sustainability Science Course in addition to their master's degree. In the case of the Sustainability Science Program, students can receive a Certificate of the Sustainability Science Program once they have fulfilled the requirement of 6 credits from Basic Subjects or Practical Subjects and 4 credits from Specialized Subjects authorized by the respective graduate schools (this requirement differs slightly depending on the graduate school).

Ibaraki University anticipates that graduates who finish this education program will be equipped to contribute both locally and globally in such fields as government, business, education, international organizations, NGOs and NPOs.

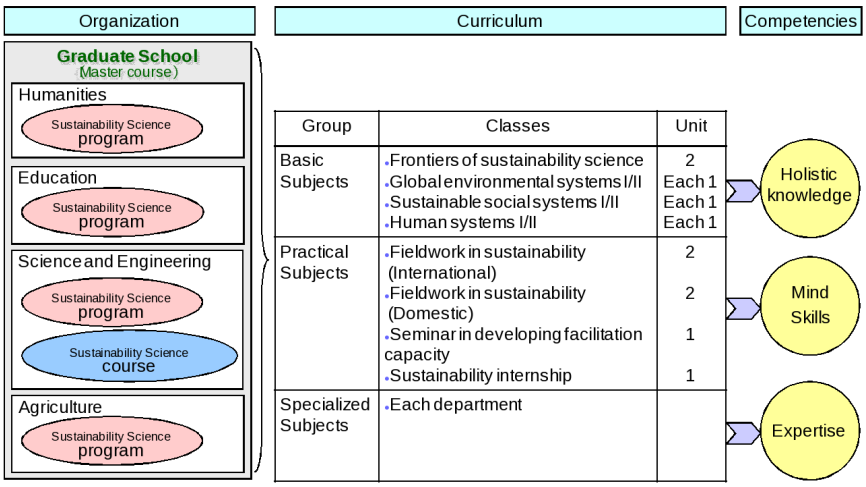


Figure 10.5: Graduate Program on Sustainability Science at Ibaraki University

	Sustainability Science Course	Sustainability Science Program
Requirement	30 credits from the regular curriculum (includes 6 credits from Basic Subjects and 2 credits from Practical Subjects)	6 credits (from Basic Subjects or Practical Subjects) and completion of 4 credits in Special Subjects authorized by the respective graduate schools
Degree or Certificate	Certificate of Sustainability Science Course	Certificate of Sustainability Science Program
Students	Graduate students	Graduate students
Organization	Graduate School of Science and Engineering	All graduate schools at Ibaraki University (Humanities, Education, Science and Engineering, Agriculture)

Table 10.1: Comparison of Course and Program in Sustainability Science

Reference

Ai Hiramatsu, Nobuo Mimura, Akimasa Sumi(2008): A mapping of global warming research based on IPCC AR4, Sustainability Science, vol.3, No.2, Springer, pp.201-203

END TO END APPROACH IN CLIMATE CHANGE ADAPTATION

Summarized from the Presentation of Prof. Toshio Koike
Head, Department of Civil Engineering University of Tokyo, Japan

Adapting to climate change has many many facets. We may identify three major facets as the

1. Scientific Approach
2. Engineering Approach
3. Socio-Economic Approach

All these three aspects are important for the successful adaptation to climate change and an understanding of each approach and their interrelation can contribute very much to successful adaptation practices.

An overview of these process are shown in Figure 10.6. In the scientific approach, the process is to use climate models for projecting scenarios and downscaling them using either dynamic or statistic models. However, as is well known, different models tend to produce different forecasts and they are not very good at reproducing historical data accurately. Thus, quantifying and reducing uncertainty is the key challenge. This can be achieved only by increased field observations, improving understanding of governing processes that would lead to improved quality data at basin scale. It is very important not to depend on a particular model, but to use multi-model Ensemble values in predictions.

In the engineering approach, the forecasts of scientific disciplines are used to meet practical demands such as flood control or drought control. Based on the forecasts systems can be operated to minimize losses and maximize benefits.

The Figure 10.7a shows the increase of 5, 10 or 100 year probable rainfall under different climate projections. Figure10.7b shows although the results of different model estimates for 10 year daily rainfall in A1B scenario would be different, it is possible to adapt an average value of 1.2 increment. Once the rainfall increment is estimated, the new projected rainfall can be used to estimate the resulting hydrological responses of catchments (10.7c) and the resulting inundation areas (10.7d) using mathematical simulations.

To design effective adaptation measures, it is imperative to investigate the socio-economic conditions in the communities affected. Their perceptions on climate change impacts should be understood and where ever necessary (10.8a), awareness be raised to respond effectively. The effectiveness of early warning systems can be ensured and improved by establishing means for communities to participate in the process and contribute to mitigation strategies (10.8b).

There are a number of ongoing programs coordinated by the the University of Tokyo which can contribute to the CECAR activities in implementing *end-to-end approaches in climate change adaptation*. The **DIAS** data base is a sophisticated and powerful data integration and analysis system that collect information from various sources and integrate them with model forecasts to provide a comprehensive information base that

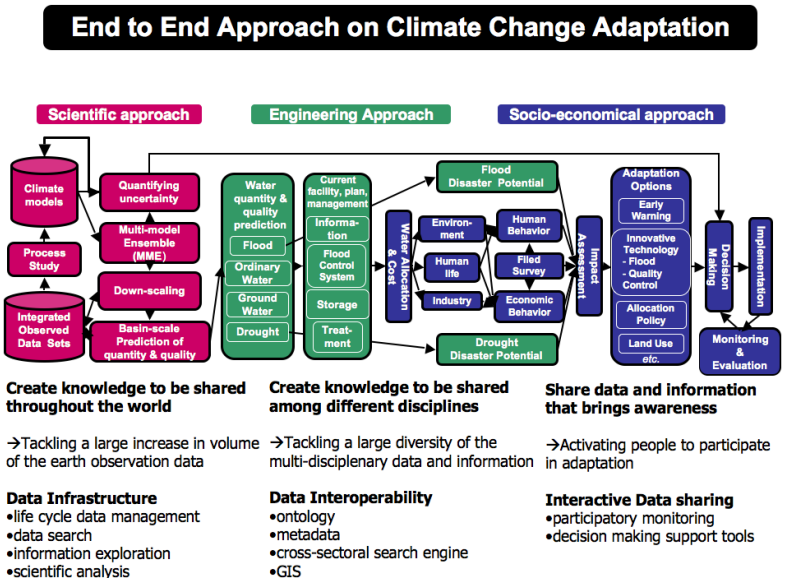
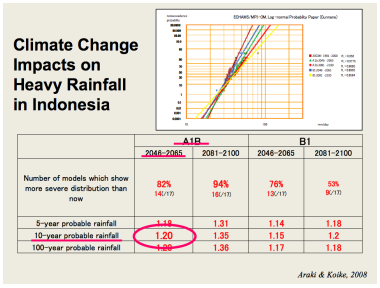


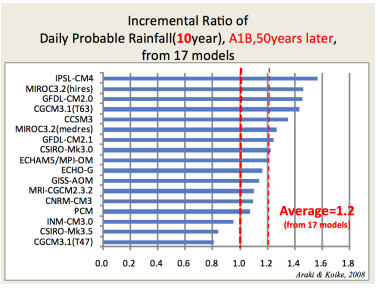
Figure 10.6: End to end approach to climate change adaptation

can provide information pertaining to both natural and social systems affected by climate and eco-systems change (10.9a).

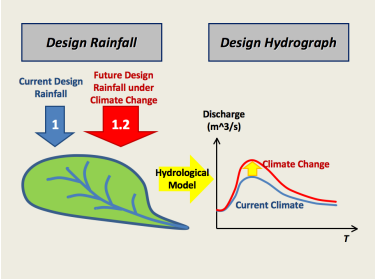
The Asia Water Cycle Initiative (AWCI) under the Global Earth Observation System of Systems (GEOSS) can be an important demonstration project site; for that can CECAR can be engaged in developing and applying tools and methodologies to assess impacts of climate change develop adaptation strategies. This program is participated by 19 member countries where all relevant information for 18 basins are collected in the DIAS system to enable end-to-end approaches in climate change adaptation. There can be mutually beneficial synergies between the CECAR activities and the AWCI, especially as UNU is involved in both of these initiatives.



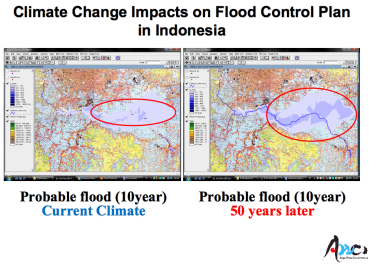
(a) Climate change impact on heavy rain in Indonesia



(b) Daily probable rain increase

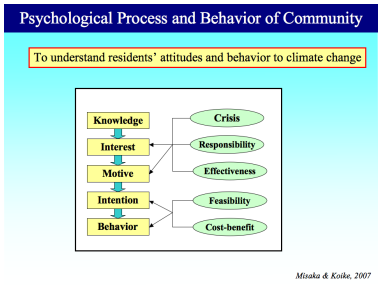


(c) Incorporating projections in hydrologic estimation

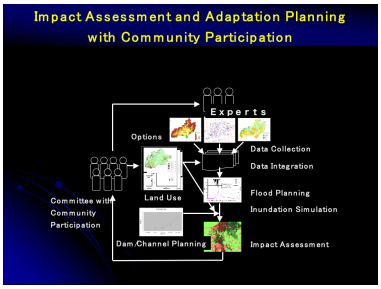


(d) Flood inundation increase due to CC

Figure 10.7: Engineering Approach aspects

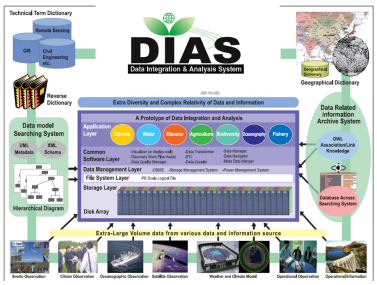


(a) Community behavior



(b) Adaptation planning with communities

Figure 10.8: Socio Economic Approach aspects



(a) DIAS: Integrated data archiving systems

(b) GEOSS/AWCI demonstration project sites

Figure 10.9

Part III

WORKSHOP PROCEEDINGS

11

CECAR WORKSHOP: PROGRAMME

11.1 AIT ACTIVITIES IN CLIMATE CHANGE AREA

Prof. Sudip K. Rakshit
Vice-President, Asian Institute of Technology

Prof. Rakshit provided an overview of climate research being conducted at the Asian Institute of Technology (AIT). AIT has been working in the area of sustainable development for more than two decades. They are now in the process of consolidating this research for climate change under the broader umbrella of Sustainable Development, to strengthen its contribution towards knowledge generation and development. Some examples of thematic climate change related sub-groups that have been part of the institute work program include: Vulnerability and Disaster Risk Reduction, Water Resources and Coastal Adaptation, Urban and Rural Sustainability, Agriculture, Land Use and Forestry, Low Carbon Society and Renewable Technology, and Cleaner Production and Waste Refinery. Building on these experiences, AIT starts a new program titled *Sustainable Development in the context of Climate Change*. It adopts a multi-pronged strategy that consists of

1. including climate aspects in all courses
2. start a specialized course in business aspects of climate change
3. provide training for senior policy makers

Research at AIT
Sustainable development in the context of Climate Change

Thematic knowledge area in Strategy Development Plan of Institute

WHY "SUSTAINABLE DEVELOPMENT IN THE CONTEXT OF CLIMATE CHANGE?"

Based on :

Considerable experience in the region

Working in the area of sustainable development for more than 2 decades

Consolidating this research for Climate Change under broader umbrella of Sustainable Development to strengthen contribution towards knowledge generation and development.

A strong base composed of networking and collaborating partners focusing on the thematic area with broad support from various donor agencies and stakeholders

www.ait.asia

11.2 OVERVIEW OF THE CECAR WORKSHOP AND EXPECTATIONS

Dr. Srikantha Herath
Senior Academic Programme Officer, UNU-ISP

Prof. Herath gave a brief introduction of the motivation and history of UN-CECAR, including a quick overview of the past three workshops: Tokyo (10-12 June 2009), Ha Long Bay (23-24 August 2009), and Accra (16-17 October 2009).

Through these workshops the objectives of UN-CECAR has become refined and its immediate objectives and activities clearly identified. Based on the previous UN-CECAR meeting in August 2009 in Halong Bay, UNU designed 9 projects and provided basic funding to carry out for the task forces identified at Halong Bay meeting. These studies are,

1. Country needs assessment (4 country teams)
2. Curriculum Development (3 task groups)
3. Research Development (2 groups)

The current workshop will review the progress so far and identify specific activities for the coming 6 months. Prof. Herath proposed the following agenda and discussion items to be taken up in the workshop.

- Needs Assessment (4 country presentations)
  Chair: Prof. Rahman (BUET)
- Curriculum Development(3 task group presentations)
  Chair: Prof. Mohanty (IIT)
- Research Development(2 task group presentations)
  Chair: Prof. Rakshit (AIT)

- Program Synthesis: Identify common elements
- Discussion items for next steps:
  - Curriculum development: Time line for completion of content for some courses (By August, 2010)
  - Process for readying for delivery and testing (certifying, credits, Test course with students, feedback, improvement and sharing)
  - Program development (joint Masters, course combinations, 2010-2011)
  - Research development (GAR, etc.)
  - Opening membership to universities in the region
  - Inviting advisory members
  - New initiatives: Ex. ASEAN M.Sc.in Climate Change (VNU)
  - Sharing resources
  - Research collaboration with ongoing programs
  - Next WS: 2010 (November) and 2011 (December)
  - cecar.unu.edu Web site
    - Newsletter
    - University Flagship research project introduction
    - Current issue Article
    - Courses Repository
    - Designation of contact persons for exchange

At the end of the day an action plan is to be established based on the discussion outcomes.

12 CECAR WORKSHOP: INTERIM REPORTS OF CECAR STUDIES

12.1 ASSESSMENT OF HIGHER EDUCATION AND RESEARCH NEEDS IN CLIMATE AND ECOSYSTEMS CHANGE AND ADAPTATION

Within the framework of the UN-CECAR, a Country Assessment of Higher Education Needs for Climate and Ecosystems Change and Adaptation was initiated by UNU on a pilot basis across 4 countries: China, Nepal, Sri Lanka and Malaysia. The four countries where chosen in order to cover the full range of geographic, topographic, climatic and social diversity that exists in the Asia-Pacific region.

The overall objective of Needs Assessment is to map the 'real' need for enhancing climate change (and related) courses or degree programs in selected countries through surveys and consultative workshops and meetings with various stakeholders. A key strategy of the needs assessment was to focus on the 'suppliers' of climate knowledge and the sectors with high demand for climate knowledge.

12.1.1 *China*

Prof. Guangheng Ni
Institute of Hydrology and Water Resources, Tsinghua University, Beijing 100084, China

Introduction

The country needs assessment of China was implemented by a group of professors from the Institute of Hydrology and Water resources of Tsinghua University. The study was carried out in two ways: (a) interviews with fifty professionals and students in the areas related to climate and ecosystems change; and, (b) a data search of relevant publications, organization homepages, etc.

The key suppliers of climate change knowledge

The key suppliers of climate change knowledge are identified as government, R&D institutions, higher education institutions, etc.

The central government is paying a great deal of attention to climate change. The politburo have had two plenary meetings studying climate change, in 2008 and 2009. Almost all the ministries of the government have a section related to climate change. Taking the Ministry of Science and Technology (MOST) as an example, more and more climate change related projects have been supported.

R&D institutions of both the central government and ministries are important knowledge suppliers through their support of research on

climate change. Climate change impacts and adaption for water, food, ecosystems, etc., are of special interest to corresponding sectors.

Several universities, such as Tsinghua University, Peking University, Beijing Normal University and Nanjing University, offer programs related to climate and ecosystem changes and adaptation. Courses are provided for undergraduate, graduate, and continuing education. At some universities, even new institutes or colleges have been established for climate change education and research.

Websites, journals and books, and workshops are the main sources by which climate change related knowledge is obtained. Along with its rapid development, international collaboration is becoming one important activity to get access to the most recent advances in climate change.

The priority areas of demand for relevant graduates and specialists

Climate change is a subject of multiple disciplines, including sociology, economics, politics, anthropology, ecology, earth system science, as well as atmospheric science and climatology. Thus sectors related to these subjects have a demand for relevant graduates and specialists. Subdivisions in different sectors related to climate change are relatively new and therefore more graduates and specialists are needed. As climate change has a close connection with state strategy and public affairs, both experiences and knowledge are required. Priorities include R&D institutions and graduates specializing in climate change. In universities, graduates have to be responsible for both teaching and research, and usually graduates with Ph.D.s are preferred. As far as climate change is concerned, gender is not an issue.

According to the Ministry of Education, till 2008, the total number of higher education institutions is 2263. Out of that, 533 are comprehensive universities, and others are specialized in natural science & technology, agriculture, forestry, medicine & pharmacy or other fields. These higher education institutions are expected to play an important role in providing state-of-the-art knowledge, decision making support etc. Higher education institutions should carry out research involving multiple disciplines, providing courses for master and doctoral studies, as well as high level training.

Existing and future barriers and gaps

Research on climate change on a global or regional scale is always conducted by higher education and R&D institutions, and the achievements should be closely related to decision making, industrial practices etc. Studies of climate change are supported by different sectors and enhanced collaboration and exchange among research teams is needed to reach more integrated and practical solutions in an efficient way.

Addressing climate change itself and the study of it will be a long process: our knowledge is far from enough and more attention and funding should be made available. International collaboration should be further strengthened for the professors or researchers to catch up with

the state-of-the-art knowledge of climate change and to possess a world view of this field. The Low Carbon Energy University Alliance (LCEUA) between Tsinghua, Cambridge and MIT that is already functioning is one of good examples in this direction.

Summary and Suggestions

Climate change is a subject involving multiple disciplines, and a problem of world interests. Higher education should take a leading role in knowledge creation and dissemination, and providing decision making support. Although some courses and even programs for climate change and adaption are there, coordination and international collaboration are needed to bring them to a higher quality. For this, collaboration among both domestic and international universities should be strengthened by sharing the most advance research achievements, having the same curriculum for climate change, exchanging professors and students etc.

12.1.2 *Nepal*

Prof. Rabindra Nath Shrestha
Head, Department of Civil Engineering, Institute of Engineering

Designing the Survey Form

The objective of the survey was to appraise the status of Nepal with respect to higher education in the field of climate change adaptation. As this field can encompass a large number of disciplines such as engineering, socio-economy and policy, the possibility of finding existing modules in a Nepalese university curriculum and which suit this subject area, would be high. On the other hand, the diverse nature of this subject may require the combination of more than one faculty as they are traditionally separated into specific disciplines. At the same time, employers needs from government, non-government and private sector may be diverse, depending on the nature of their businesses and the awareness on the climate change and related issues. In order to evaluate this diverse status in detail, two forms were designed; one for educational sector (the provider of climate change knowledge) and another one for the non-educational sector (those who demand climate change knowledge).

Consultative Workshop

A consultative workshop, held in February 2010, was jointly organized by UNU, Center for Energy Studies (CES), Institute of Engineering, Tribhuvan University with the association of Department of Civil Engineering, Pulchowk Campus of Tribhuvan University, Nepal. The workshop was aimed at exchanging information on climate change issues relevant to the Nepalese context; sharing information about the needs for higher education; and to identify types of courses that are

suitable for enhancing the capacities of university staff, employees of government, non-government and private sector.

The workshop was attended by 66 participants representing well over 40 agencies. The 1-day workshop included an Opening Ceremony, a Plenary Session and a Break-out Session. The opening ceremony comprised of 9 speeches with a keynote speech by Prof. Ram Manohar Shrestha, former faculty member of the Asian Institute of Technology. The Plenary session included 4 presentations from a number of international agencies. In order to exchange ideas pertaining to the status of Nepal, the participants were separated into two groups; one group to identify higher education needs and the other to discuss how to support and meet these needs.

Breakout sessions

When participants reassembled after the Plenary session, they were separated into two Working Groups. One group discussed the needs at the national level: from government agencies to NGOs and the private sector (Service Demand). The other group discussed strategies to deliver the needs by thoroughly studying components of climate change adaptation courses (Service Provider).

The Service Demand group found that a broad-based need assessment for all agencies need to be carried out further. The group expressed their concern over the sustainability of courses once launched as they needed proper political support by the government to establish and enforce required policies.

The Service Provider group identified existing Masters Courses as Renewable energy, water, environ engineering, urban planning, disaster management, agriculture, forestry and public health. They discussed the availability of resources within Nepal and concluded that climate change expertise was lacking.

Both groups discussed the barriers they are facing and future constraints that may occur in offering and investing on courses for capacity development. The key barriers identified were: lack of funding, including that needed for research; adequate human resources; international/regional networks; laboratory infrastructure; databases for long term climate change studies; national educational policies and long term planning; and, political commitment.

12.1.3 *Sri Lanka*

Prof. S. B. S. Abayakoon
Vice Chancellor, University of Peradeniya

Climate Change Adaptation

Background

In Sri Lanka, research in the general area of climate change and its effects are being conducted at a number of institutions including all

national universities and entities come under government ministries. However, a clear focus on "adaptation" does not seem to be a prime concern although some research on adaptation to climate changes is being carried out at several places.

Some areas of interest are, Water and water Resources, Agriculture and Forestry, Energy Saving, Manufacturing, Health and Nutrition and Coastal Resources. Issues such as adaptation to rainfall pattern changes, water shortages, sea level rise, de/reforestration, energy saving buildings, fuel efficiency, pollution control, vector and rodent borne diseases, landslides, floods etc are extensively conducted.

A very limited amount of financial support is available through many channels. Although the government seems to consider climate change adaptation as a need of the hour, a focused and co-ordinated effort is not to be identified. University research is done mostly because of individual interest and the work done at several government agencies are also not known to each other properly. Ironically, there is no shortage of forums organized on climate change by various bodies.

Country Needs

It is necessary to identify all who have an interest and who are working in the area of climate change adaptation. It is presently being done by the University of Peradeniya through the initiatives provided by the United Nations University.

A central institute must be established to link up the research being carried out and to co-ordinate, monitor and propose future directions. This will also avoid duplication of work and will regularize data collection procedures.

Educators must be provided with easy access to the knowhow, resources and incentives for capacity building within Sri Lanka. Undergraduate degree programmes should be modified to include adaptation aspects. Further well focused research programmes in adaptation leading to higher degrees must be carried out at the universities.

It is necessary for the academia and senior administrators to act together as a pressure group to the government for the purpose of initiating policy changes, introducing relevant acts through legislature, reactivating the rules and regulations that are presently established and to allocate and look for sufficient funding.

Dissemination of knowledge to the general public and the junior level administrators must be considered as an immediate need. This should be done in an interactive manner and it is advisable to consider views of these groups in policy planning. A case in point may be avoiding panic situations.

Implementation

Implementation must be through a dialogue among academia, senior administrators and the political hierarchy of the government

12.1.4 *Malaysia*

Presented by Prof. Joy Jacqueline Pereira
Joy Jacqueline Pereira, Rawshan Ara Begum, Sharifah Zarina Syed Zakaria, Sarah Aziz Abdul Ghani & Mazlin Mokhtar
Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia

The United Nations University (UNU) commissioned the Institute for Environment and Development (LESTARI) of Universiti Kebangsaan Malaysia to conduct a Country Assessment of Higher Education Needs for Climate and Ecosystems Change and Adaptation in December 2009. The study is undertaken within the framework of the University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR). The objective of the assessment is to map the genuine need for enhancing climate change and related degree programs in the country. The findings will serve to inform UN-CECAR members in the development of a region-wide curricula program on adaptation to changes in climate and ecosystems.

The study comprised web-based surveys, stakeholder consultations and a questionnaire-based survey. The web-based survey of the top 50 universities of the world was conducted to review the scope and characteristics of graduate and undergraduate programs related to climate and ecosystems change. The web-based survey was then extended to the 20 public universities in Malaysia in an effort to delineate graduate and undergraduate programs related to climate and ecosystems change. A web-based survey was also conducted to identify other non-university entities that conducted programmes related to climate and ecosystems change in Malaysia. The study also obtained inputs from stakeholders through group consultation and on an individual basis from representatives of selected institutions. The group consultations were general and confined to specific topics. Inputs from individuals were more detailed and obtained in a very structured manner using a questionnaire that covering a range of topics.

Universities are the primary supplier of climate change knowledge. A cursory web-review of the top 50 universities of the world revealed that there are four graduate and undergraduate programmes that are related to adaptation, climate and ecosystem changes. These can be clustered together as (1) climate science, (2) ecology/ecosystems, (3) environmental studies, and (4) earth system science, focusing on remote sensing and GIS applications. Most universities have programmes in either one or two of the four clusters of topics. Several have a combination of three clusters and these are generally in climate science, earth system science and environmental studies, focusing heavily on the physical sciences. Very few universities offer programmes in all four of the cluster areas. The review of 20 government funded public universities in Malaysia revealed that a majority of the universities only offer programmes in only one of the cluster areas related to adaptation, climate and ecosystem changes. There are six universities that offer

programmes in at least two of the cluster areas related to adaptation, climate and ecosystem changes. Of these, only three universities have programmes in all four of the clusters.

In addition to universities, other key suppliers of climate change knowledge in the country are R&D organisations, government agencies, NGOs and networks. Generally, R&D organisations conduct applied research to provide technical support to other government agencies including Ministries and Departments in implementation of policies, plans and programmes. In addition to this, government agencies also have R&D support units within their own organisations for strategic research. The employees of R&D organisations and government agencies are civil servants, with a minimum qualification of Bachelors degree in various disciplines. Civil servants are encouraged to pursue postgraduate degrees up to the Ph.D. level to enhance their chances for promotion. There are at least ten NGOs devoted to promotion of awareness and capacity building of communities and the private sector. The NGOs generally have limited resources and are very dependent on projects to cover their overheads. There is no systematic career development plan for their employees. A majority of the employees have a minimum qualification of Bachelors degree in various environment related disciplines.

The study revealed that climate change is expected to impact ecosystems, the physical environment and societal well-being in the country. Resource sectors are perceived to be more vulnerable and these include agriculture, biodiversity, coastal and marine, forestry and water sectors. The health sector is also expected to be greatly impacted whilst the impact on energy, industry, manufacturing and services is perceived to be relatively less critical. The general perception is that Malaysia has sufficient resources and expertise to address the consequences associated to climate and ecosystems change. Notwithstanding this, there is strong agreement on the need to develop skill and expertise in adapting to changes in climate and ecosystems. The prevailing opinion is that there is not enough trained or experienced professionals and specialists to help for adaptation in climate and ecosystems change. Many non-university entities are willing to hire human resource with an educational background on climate change and ecosystems. With respect to academic qualification, the demand is for Ph.D. and Masters graduates.

The current awareness of ecosystems in its broadest interpretation is rather limited in the country. The perception is that adaptation to climate and ecosystem changes is constricted to the resource sector. The idea that an ecosystems approach could be applied to strengthen adaptive capacity to changing climatic conditions in physical, social, urban, industrial and economic management should be promoted. The creation of such awareness would result in enlarging the market for graduates of such an education programme, to extend beyond the government to the private sector. This will contribute to ensure sustainability of an education programme adaptation to climate and ecosystem changes.

12.2 CURRICULUM PROPOSALS

12.2.1 *Science of Climate Change: Curriculum Proposal*

Prof. Lindesay

Prof. Lindesay briefly introduced the underlying principles to be covered under the course on Science of Climate Change.

Underlying Principles

1. Course development for postgraduate (Master) program/s
2. Core courses delivered via a common platform (e.g. online, or at UNU)
3. Each course equivalent to 30 lecture hours (2 credits)
4. Framework of content, and module topics

She proposed the following core, specialized and cross-cutting courses, and the potential modules within each category:

Core courses (and modules)

1. Weather & climate
2. Climate change science
3. Climate change impacts science.

Specialized

1. Climate modeling
2. Climate model applications for adaptation
3. Ecological responses to climate change

Cross-cutting

1. Sustainability Science
2. Predictability, uncertainty & decision making

Prof. Lindesay also raised some of the key discussion points that needed to be clarified. They included: How to collaborate among the three themes of climate change science, impacts and vulnerabilities, and adaptation and mitigation; Content development; Module length – depth & detail; Complete package for the program; and Potential delivery of the content into undergraduate programs.

12.2.2 *Interim Report for an MSC Curriculum on Climate Change/ Curriculum on Impacts and Vulnerabilities*

Prof. Pham Van Cu
Vietnam National University
Prepared by the Vietnam National University (VNU) working group on climate change

Further to the recommendations of the Tokyo Conference held in June 2009, UNU and VNU, Hanoi, jointly organized a conference on 22-23 August 2009 in Ha Long, Vietnam. One of the technical groups from this Ha Long conference has been working on development of curricula focusing on climate change adaptation and development of strategy for implementing the adaptation concept and idea into public action.

According to the recommendations of Ha Long Conference, VNU, Hanoi takes the responsibility to develop the syllabus for the one of three focus areas: that of "Impact and Vulnerability".

VNU's School of Graduate Studies (SGS), Hanoi, is assigned as coordinator of this contract and SGS has involved the professors and participants from different colleges, schools, faculties, and departments. The participants have been making a series of email exchanges before and after each meeting organized by SGS. Brainstorming sessions were the essential method used for program development.

Program Objectives

As a component of the Master Program in Climate Change, the Focus Area "Impact and Vulnerability" course is designed to provide key scientific theoretical issues of climate change, impact and vulnerability assessment methodology to those who wish to carry out research work in climate change science. In parallel, the program aims also to provide to the people working in policy and decision making in government institutions and to those work in NGOs and Consultancy Firms with the practical skills they need for their professional careers.

This program aims to bridge the gap between the scientific research and the decision-making communities in key scientific climate change, its impact and adaptation issues. The program contributes to build the capacity of higher quality education on climate change in developing countries. It is an international program which is designed to provide students with a broad understanding of the practice and research of climate change and share local experiences in a regional and international context by:

- Developing the human resources to cover the requirements in climate change research and sustainable development strategy establishment in both global and local context and covering three sectors: 1) Research, 2) Policy and Decision Making and 3) Consultancy;

- Developing an inter-university networks of higher education in climate change sciences and vulnerability assessment and adaptation; and
- Associating and linking the education to research programs on climate change and adaptation at regional and local scale.

Proposed syllabus and potential modules

Core courses (and modules)

1. Understanding climate change
2. Ecosystem services and limate change

Specialized

1. Spatial Analysis
2. Climate change impacts and vulnerabilities

Cross-cutting

1. Climate change governance
2. Climate change and community adaptation

12.2.3 *Developing a Curriculum on Climate Change Adaptation and Mitigation*

Dr. Tumiran and Team
Universitas Gadjah Mada, Yogyakarta, Indonesia

Introduction

Climate change is perhaps among the most important issues faced by people across the world today. Climate change and the damage to the eco-system have been triggered by technological discoveries achieved by humans a couple of hundred years ago, and accelerated since the industrial revolution. The development of industries supported by the huge exploitation of natural resources, and the utilization of vast amounts of fuel for manufacturing, transportation, household and industrial needs, significantly increased the amount of GHGs such as CO2, CO, CH4 and NOx in the atmosphere. Population growth and economic development have triggered large-scale deforestation for agriculture and other purposes. Infrastructure development, office and residential developments have also significantly decreased the amount of green spaces world-wide resulting in the further increase of GHG levels in the atmosphere.

Public awareness of the problems related to climate and eco-system change has not been fully developed yet in the minds of most people, whether they are researchers, governments, professionals, politicians or the general public. Many different opinions and thoughts still exist due to limited knowledge. Experts and researchers in higher education or research institutions who understand the impacts of climate and ecosystems change are anxious and concerned that most people care little for the issue and consequently have not taken the necessary actions or coordinated collective efforts to decrease the effects of climate change. Hence, an integrated and cross-sector sharing of ideas and approaches, which every community can adopt, needs to be developed. Actions should also be transformed in such away to allow all people, whether they are researchers, governments, professionals, politicians or common people, can continue their daily activities in such a way that also incorporates adaptation to climate and eco-system change with little effort or cost.

Frame of Thinking

Two important factors need to be taken into consideration; firstly, the development of integrated and cross-sector thoughts/ideas that are possible for every community to easily adopt (governments/business sectors/ local community of common people/ academia/researcher, etc) and secondly, how to transfer such knowledge/thoughts/ideas to different people in different communities. Hence, one of the main objectives of the post-graduate study program in climate and ecosystems change adaptation is to produce graduates who not only have a comprehensive understanding of climate change issues, but who also

have the competencies to develop alternative solutions and adaptation strategies to climate and eco-system change especially at the community level and who are able to communicate and work across a variety of levels and disciplines to develop adaptation policy and actions.

Another point that should be considered when developing the following frame is that even though climate change is a global process, local situations such as the geographical condition, bio-physical and socio-economic characteristics should be considered in developing strategies to address climate change. Higher education institutions including post graduate students, teachers and researchers should work closely with local communities and local governments. This close cooperation will allow local governments and local communities to evolve its own strategies and action plans for climate change adaptation.

The frame starts with a conceptual understanding on climate change and sustainable development and with some climate change assessment and practical works. In the middle between the conceptual understanding and practical works, there are courses related to community development and capacity building, governance and management, communication and networking and risk management and mitigation. Each course requires different amounts of conceptual understanding, theories, best practices and practical works.

Titles of the courses

1. Climate change and sustainable development
2. Capacity building and community development
3. Governance and management
4. Communication and Networking
5. Risk Management and Mitigation Strategy
6. Climate change assessment tools and advocacy strategy
7. Practical works and final report

Notes on the implementation of the curriculum

The implementation of such curriculum in adaptation and mitigation requires two-way interaction between postgraduate programs and local community (and local government). In one direction, the local community and local government serve as a source of information, data and potential research topics for higher education institutions. In another direction, higher education institution including its students, teachers and researchers can share their knowledge with local community and local government. Simultaneously, students, teachers and researchers can learn social-cultural approaches and local wisdom from the people of the community. This local wisdom, which is reflected in their best practices, should be maintained continuously and enhanced by modern knowledge and technology provided the higher education institutions.

Another important role of higher education institution is in relation to the network development among stake-holders (local higher education institution, local government, local community, local enterprises, and other stake holders) that can participate in climate change adaptation.

12.3 JOINT RESEARCH DEVELOPMENT

12.3.1 *Research modules on climate and ecosystems change related to sudden onset disasters*

Presented by Prof. G. Q. Tabios III (Coordinator) for G.Q. Tabios, R. Shrestha, M. Rahman, U. Mohanty, S. Abayakoon, S. Lee and Tumiran (UN-CECAR Yogyakarta, Indonesia Meeting on March 10, 2010)

During the UN-CECAR meeting in Halong Bay on August 24, 2009, it was agreed that the two areas of joint/collaborative research development are: 1) extreme events or sudden onset disasters related to climate change; and 2) disaster associated to long term or slow change impacts from climate change. Furthermore, these researches should focus on: 1) phenomena and/or physical characteristics; 2) impacts on landscapes and ecosystems; 3) mitigation measures in the context of climate change adaptation. From that meeting, the action plan are as follows: 1) designate key institutes to prepare capsule (module) proposals for each topics listed above in which a research project template will be provided to make the proposals; 2) define research priorities and agenda for UN-CECAR; and 3) develop research modules.

The research modules serve as templates or framework for climate and ecosystems change studies that can be used by UN-CECAR members. One or more research modules can be developed into full blown research proposal for possible funding tailored to a particular study area and depending upon donor specifications. It is expected that the actual research works will be a joint and collaborative research among member institutions or countries since resources to conduct climate and ecosystem change studies may be available only to some countries (e.g., GCM model from Japan) while other countries may have the unique and indigenous local knowledge or experiences.

The first step in developing these research modules is to write capsule proposal with format shown below. The capsule proposal include a names of proponent, project site, objectives, methodology, activities and schedule, budget breakdown, project management and monitoring and evaluation. These capsule proposals should have enough details to serve as templates or guide as standalone proposals. The second step is to develop full research proposals as joint and collaborative research for the UN-CECAR members to seek funding.

So far, the researches to be written into research modules are as follows:

1. Regional downscaling of global circulation model products for localized climate change adaptation studies (India)
2. Climate change and extreme weather events over Indian subcontinent
3. Assessment of occurrence of severe tropical cyclones over Bay of Bengal leading to extreme storm surges and coastal flooding for various global warming scenarios (India)

4. Hydrologic cycles variations due to global climate change in a river basin (Korea)
5. Hydrologic extreme regimes and impacts by climate change (Korea)
6. Hydrologic environment and watershed impact by climate and ecosystems change (Korea)
7. Appropriate landscaping for the coastal areas of Bangladesh
8. Flood vulnerability assessment in the lower Meghua basin catchment (Bangladesh)
9. Climate change and adaptive measures for flooded urban area – Dhaka, Bangladesh, a critical example
10. Rainfall-triggered landslide and debris flow regimes under various climate change scenarios in the east slope of the Sierra Madre Ranges of Aurora-Quezon, Philippines
11. Quantifying the multiplicative effects of climate change, land use changes and urbanization on floodings of Marikina River basin of Metro Manila, Philippines
12. Ecological impacts of rapid changes in river morphology due to extreme events associated to climate change (Philippines)
13. Landslide, triggering factors and mitigation in Sri Lanka
14. Dam break analysis in Sri Lanka
15. Glacier lake outburst flood in Nepal – Case Study
16. Flood forecasting for river in Nepal
17. Floods and landslides in roads in Nepal

During this UN-CECAR meeting in Jogyakarta, it was decided that the time line for this research development activity on sudden onset disasters are the following:

1. Finalize research topics for capsule (module) proposal writing in next 2 weeks.
2. Submit (detailed) capsule research proposals by late May 2010.
3. Classify, identify and then develop the joint/collaborative full research proposals based on the capsule proposal during the period of June 2010. Note that classification can be based on research focus (phenomena/mitigation/landscapes) and the identification for joint research based on study area, methodologies, resource sharing, funding source.
4. Finally, submit full research proposals by early September 2010 and decide when and where to submit these full proposals for possible funding.

12.3.2 *A concept proposal for climate and ecosystem adaptation studies to slow onset disaster in land degradation*

Prof. Li Diqiang
Director Institute of Forest Ecology, Environment and Protection, Chinese Academy of Forestry

Rationale

Land degradation is a human-induced or natural process which negatively affects the productivity of land within an ecosystem. The direct causes of land degradation are geographically specific. Land degradation—especially desertification and deforestation has triggered large-scale population movements, disrupted economic development prospects, aggravated regional conflicts and instability, and threatened the lives and livelihoods of people living under its shadow. Causes of land degradation are not only biophysical, but also socioeconomic (e.g. land tenure, marketing, institutional support, income and human health) and political (e.g. incentives, political stability). According to UNCCD, the consequences of land degradation include undermining of food production, famine, increased social costs, decline in the quantity and quality of fresh water supplies, increased poverty and political instability, reduction in the land's resilience to natural climate variability and decreased soil productivity.

Land degradation involves two interlocking, complex systems: the natural ecosystem and the human social system. Natural forces, through periodic stresses of extreme and persistent climatic events, and human use and abuse of sensitive and vulnerable dry land ecosystems, often act in unison, creating feedback processes, which are not fully understood. Interactions between the two systems determine the success or failure of resource management program. Climate change, including changes in short-term variation, as well as long-term gradual changes in temperature and precipitation, is expected to be an additional stress on rates of land degradation. Climate change-induced land degradation is expected through: changes in the length of days and/or seasons; recurrence of droughts, floods, and other extreme climatic events; changes in temperature and precipitation which in turn reduces vegetation cover, water resource availability, and soil quality; and changes in land-use practices, such as conversion of lands, pollution, and depletion of soil nutrients.

The suggested proposal is particularly focused on regions where increased rates of land degradation due to climate change are likely to decrease livelihood opportunities and worsen rural poverty. The underlying adaptive capacity of both the ecosystem and communities will determine the extent and direction of impacts. The focus of projects should be on reducing the impacts of climate change on land degradation over and beyond measures that would normally be undertaken as a land degradation focal area activity. Maintaining and/or strengthening the resilience of ecosystems and communities to climate change by reducing the rates of land degradation (caused by climate change) is

a priority. Projects should reflect dynamic, long-term response measures that can effectively contribute towards the reduction of climate change-induced land degradation.

Project concept

The general goal of the project is to create land degradation control and biodiversity conservation demonstration in adapting to ecosystem and climate change

Specific objectives are to: identify and map slow onset disasters in land degradation in the project sites; assess the root causes of land degradation in different land management practices; conduct vulnerability assessment to ecosystem and climate change at the site and regional level; predict the potential impacts under different climate change scenarios, develop effective land degradation approaches in different sites; create a platform for land degradation control and management in adapting to ecosystem and climate change; and, establish training site and knowledge sharing platform for UNCECAR

In each physical site, we should understand the current status through mapping and description of land degradation using RS, GIS and GPS based field surveys, then, try to study the mechanisms and design indicators for monitoring and evaluating land degradation. We should also Conduct vulnerability analyses for climate adaptation and assess current and changing social-economic condition and climate risk in current and future climate change scenarios. Finally, it will be important to develop studies with stakeholders on current strategies and best practices for adaptation, and adaptation strategies that continue the adaptation process.

Project Sites

Selection criteria for sites will be based on: existing research activities and adaptation practice and existing scientific databases; geographical locations and land degradation types; and, scientific questions on slow onset disaster on land and biodiversity degradation.

In China, all activities will focus on the Yellow River and Mekong Basin. We will try to develop project proposals in different areas of the 2 rivers.

The following sites have been identified:

1. Land degradation in Alpine Area: Sanjingyuan Area in Qinghai Province, Yellow River and Mekong basin.

2. Land degradation in Dryland area: Alashan Desert , in Yellow River basin.

3. Habitat degradation in Key Biodiversity area: Yunnan Baimaxueshan PA in Mekong basin

4. Land degradation in Agriculture area: Yangbi in Yunan Province in Mekong basin

5. Land degradation in Coast area: Yellow River Deltas Protected area.

13

CECAR WORKSHOP: DISCUSSION SUMMARY

All the agenda items were discussed at length during the day long workshop. A brief summary of the outcome for each agenda item is given below.

NEEDS ASSESSMENT (4 COUNTRY PRESENTATIONS) It would be useful to make the studies as close as possible to each other in terms of methodology and coverage. The Malaysian study and Nepal study have carried out questionnaire survey among relevant stake holders. It was decided that these two questionnaires would be combined to provide one standard questionnaire form. UNU will circulate the composite questionnaire and basic guide lines for the survey and the teams are expected to complete the studies by June/July.

CURRICULUM DEVELOPMENT(3 TASK GROUP PRESENTATIONS) The three task groups will meet to identify the overlaps of the proposed curricula and make a redraft of the outlines of the courses. Two detailed courses will be prepared and tested with invited Master and Ph. D. students at UNU in September. The three task force members are requested to prepare the two detailed courses as a combination of modules of proposed syllabi. UNU will be responsible to suggest the topics to be covered and to organize the testing programme. The support required for students from overseas to participate was discussed at length and the following is recommended; UNU will find funds for the tuition and stay of students in Tokyo, the students are expected to find funding for travel to Tokyo.

Research Development(2 task group presentations) The fast onset research proposal needs inputs from partner members on methodologies and proposed sites and their characteristics. The slow onset disaster proposal had concrete work plans. However, it need to modularize the proposals as discussed in Ha Long Bay meeting.

CURRICULUM DEVELOPMENT : Time line for completion of content for some courses (By August, 2010)
It was decided that two courses would be completed and then tested in September at UNU. UN-CECAR will nominate some faculties for the teaching.

PROCESS FOR READYING FOR DELIVERY AND TESTING : certifying, credits, test run with students, feedback, improvement and sharing. This process has to be further discussed and developed by UNU with the curriculum development taskforce members.

PROGRAM DEVELOPMENT : joint Masters, course combinations, 2010-2011. Discussions can start from the next UN-CECAR meeting on the joint development and delivery of a joint Master degree programme. The major challenge is the development of a framework that consist of freely available (open) basic content and specialized content offered by different institutions.

RESEARCH DEVELOPMENT (GAR, ETC.) There is a possibility of taking part in a number of international programmes, such as the Global Assessment Report of United Nations International Strategy for Disaster Reduction. These information will be disseminated via UN-CECAR web portal.

OPENING MEMBERSHIP TO UNIVERSITIES IN THE REGION This item was not discussed at length. There was no disagreement for opening the membership to all postgraduate institutions in the region.

INVITING ADVISORY MEMBERS In addition to the members who participate in UN-CECAR activities, advisory members need to be invited to provide guidance expertise to the network.

NEW INITIATIVES Prof. Cu from VNU explained the VNU proposal to ASEAN for a M.Sc.in Climate Change (VNU) for the ASEAN countries. This proposal has been accepted at the last ASEAN ministerial meeting and would draw heavily from the work of UN-CECAR

RESEARCH COLLABORATION WITH ONGOING PROGRAMS It is necessary to establish a mechanism to enter in to research collaborations with major research programs related to climate change, so that their outputs and data can be used in the CECAR network postgraduate research. This will provide rapid transfer of current global knowledge as well as improvement of newly developed tools and methodologies to suit to local conditions. This may be facilitated through the data and research information repository planned for UN-CECAR

SHARING RESOURCES Current format of international conferences provides an effective means to share information and relevant activities among member universities. However, a more robust mechanism for data and other resource sharing should be established. Based on the recommendations of the CECAR meeting in August 2009,UNU has embarked on developing a web portal for this exchange.

CECAR WEB SITE The prototype of UN-CECAR website has been established. The system consist of separate wiki sites and blogs for curriculum development, research development and exchange, needs assessment, information and document repository arranged by country, moodle system for conducting courses and many other facilities. The web site can be accessed at: http://cecar.unu.edu.

The following features are

NEWSLETTER As discussed in the 2nd UN-CECAR meeting, UN-CECAR can undertake producing a newsletter, where the editorship is rotated among members quarterly. Provisions are provided to produce and disseminate the newsletter through the website

UNIVERSITY FLAGSHIP RESEARCH PROJECT INTRODUCTION Each member university is invited to describe their flagship research project related to climate change on the CECAR website.

CURRENT ISSUE ARTICLE A 'current issues' article is prepared and disseminated on the website to disseminate current research on climate change. CECAR researchers are invited to contribute to this feature.

COURSES REPOSITORY Moodle online learning system is installed as a part of the CECAR website. This site will be used as a repository as well as a tool to conduct online courses related to and developed by CECAR.

DESIGNATION OF CONTACT PERSONS FOR EXCHANGE Each university has designated a focal point to interface with UNU to provide and receive information through the CECAR website and information repository.

NEXT WS: 2010 (NOVEMBER) AND 2011 (DECEMBER) The potential dates for next workshops were discussed as early November in 2010 and mid December in 2011. The venue is not yet finalized but most likely the 2010 conference will be held in Sri Lanka under the theme 'Sustainability and Traditional Knowlege'

A

WORKSHOP PROGRAM

DAY ONE, 8 March 2010

Venue: Post-Graduate Main Building (Gedung Pasca), Universitas Gadjah Mada

07.30- 08.00	Registration	
08.00- 08.30	OPENING	(Master of the Ceremony: Ms Karina Utami Dewi and Mr. Khoirul Amin)
	Opening remarks	Dr. Tumiran, Dean of Engineering, UGM
	Welcome Address	Prof. Sudjarwadi, Rector, UGM Prof. Kazuhiko Takeuchi, Vice Rector, UNU and Deputy Executive Director of IR3S
	Keynote Speeches	Chair: Prof. Wahyudi Budi Sediawan
08.30- 10.00	Climate and Ecosystems Change Adaptation Response in Indonesia	Prof. Emil Salim Former Minister of Environment and member, Advisory Council of the President of Indonesia
	Implementation of Indonesia's 3 higher education pillars (education, research and public service) in adapting to climate change	Prof. Dr. Fasli Jalal, Ph.D., Director of Directorate General of Higher Education of Ministry of National Education of The Republic of Indonesia
	Climate and Eco-system Change Adaptation Response	Dr (HC). Ir. Djoko Kirmanto, Dip. HE. Minister of Public Works of The Republic of Indonesia Speech delivered by Dr. Mohammad Amron, Director General Officer & Development, Ministry of Public Works)
10.00- 10.30	Short Introduction presentation to mini-expo, Photo Session & Coffee Break	
10.30- 12.00	Thematic Session 1 Chair: Prof. Bambang Hari Wibisono Role of central government, higher education and industry in adapting to climate change.	

	Implementation of three pillars (education, research and public service) in adapting to climate change : UGM's experiences	Prof. Sudjarwadi, Rector, UGM
	Energy change adaptation scenario for Indonesia's energy sector	Dr. Ir. Herman Darnel Ibrahim, M.Sc. National Energy Council (DEN) Indonesia
	Commitment of energy sector industry on sustainable development that adapt to climate change	Mr. Budi Basuki President director of Medco Energi E&P Indonesia
12.00- 13.15	Mini Expo University-community partnerships in adapting to climate change and variability: Success Stories Lunch	
13:15–14:45	Thematic Session 2 Chair: Prof. Bambang Hari Wibisono Climate change Impact and adaptation in tropical countries	
	Education for Sustainable Development in Indonesia	Assis. Prof. Eko Agus Suyono Manager of Regional Center of Expertise (RCE) Institute for Research and Community Services, UGM
	Climate change adaptation and impacts on ecosystems in Indonesia	Dr. Kardono The Agency For the Assessment and Application Technology (BPPT)
	Climate change-related tropical diseases and development of strategies for improving community resilience	Prof. Dr. Hari Kusnanto, J., SU., Dr.PH Center of tropical diseases, UGM
14.45- 15.05	Coffee break and mini-expo	
15.05- 16.25	Thematic Session 3 Chair: Prof. Soontak Lee, Yeungam University University Network for Climate and Ecosystems Change Research (UN-CECAR)	
	Regional Integrated Multi-Hazard Early Warning System (RIMES) in ADPC	Prof. Uma Charan Mohanty Centre for Atmospheric Sciences, Indian Institute of Technology
	MyCLIMATE -Mobilizing Stakeholders in Addressing Climate Change	Prof. Joy Pereira Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia
	VNU research and training for smart response to climate change	Prof. Pham Van Cu Vietnam National University

16.25-16.45	coffee break and mini-expo	
16.45-18.15	Interface session Chair: Prof. Srikantha Herath, UNU-ISP	
	University Network for Climate and Ecosystems Change (UN-CECAR)	Prof. Srikantha Herath, Senior Academic Programme Officer, UNU-ISP
	Linking Higher Education with Research and Community Activities	Prof. Nobuo Mimura, Director, Institute for Global Change Adaptation Science, Ibaraki University, Japan
	End to End Approach on Climate Change Adaptation	Prof. Toshio Koike, Head, Department of Civil Engineering, University of Tokyo, Japan
18.15-19.00	Break, preparation and transportation to dinner place.	
19.00-21.30	Cultural exhibition and Gala dinner at Balairung of Universitas Gadjah Mada	

DAY TWO, 9 March 2010

Venue:

1. Wanagama forest work field, Gunung Kidul, Yogyakarta

   Wanagama is a forest work field, of which approx. 600 Ha belongs to UGM. It is located about 36km from UGM and was established in 1966. Before the involvement of researchers and students from UGM, this area was an environmentally fragile area characterized with rough topography, low-carrying capacity, lack of off-farm job opportunities, and suffered from deforestation and soil degradation.

2. Gabug, Giri Cahyo, Purwosari, Gunung Kidul, Yogyakarta

   Water harvesting for dry remote area through utilization of renewable energy (solar cells).

   About 200 UGM's students coming from various disciplines supervised by UGM's academic staffs were involved in exploration underground river (about 100m from the surface). The work started in year 2006 and was completed in 2008. Nowadays, the project has been successful to provide water to each villager and to manage water supply system so that water supply for community will not be problem anymore, especially during dry seasons. The program is also considered successful to establish community based water supply management and system, because the local community is managing the water supply by their own organization.

07.30-09.00	Meeting point at Pascasarjana building at UGM Transportation from Pascasarjana to Wanagama Forest work field at Gunung Kidul, Yogyakarta	
09.00-10.00	Morning Session	University-community engagement in adapting to climate change
	Lessons learnt from Wanagama Forest field	Prof. Mohammad Na'iem Dean of Faculty of Forestry, UGM
	Lessons learnt from climate change impacts and adaptation in small islands	Dr. Muhammad Baiquini Faculty of Geography, UGM
10.00-12.00	Field Trip at Wanagama Forest field	
12.00-13.00	Lunch	Wanagama Forest field
13.00-14.00	Transportation to Giri Cahyo, Gunung Kidul, Yogyakarta	
14.00-15.30	Field trip at Giri Cahyo	Water harvesting in remote area utilizing solar cells
15.30-16.30	Transportation back to the hotel	

DAY THREE, 10 March 2010

Venue: Post-Graduate Main Building (Gedung Pasca), Universitas Gadjah Mada

08.00-08:05	Introductory remarks	Prof. Srikantha Herath, UNU-ISP
08.40-10:40	Needs assessment	China, Malaysia, Nepal and Sri Lanka
11.00-13:00	Curriculum Development	Science, Impacts and Vulnerability, Adaptation and Mitigation
14.00-15:00	Research Development	Slow onset and Rapid onset disasters
15.15-17.15	Plenary – summary of discussions	Prof. Srikantha Herath
17.15-17.30	Wrap-up and closing remarks	Dr. Tumiran

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UNIVERSITY

UNU-ISP

Institute for Sustainability and Peace
53-70, Jingumae 5-chome
Shibuya-ku, Tokyo 150-8925, Japan
Tel: +81-3-5467-1212
Fax: +81-3-3499-2828
E-mail: mbox@unu.edu
Website: http://www.isp.unu.edu

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