



## **CAPACITY BUILDING FOR SUSTAINABLE MANAGEMENT OF PEATLANDS IN THE HUMID TROPICS: FROM RESEARCH TO APPLICATION**

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### **ABSTRACT**

About one quarter of the world's tropical peatlands (11 million hectares) occur in Borneo. These peatlands have global ecological significance, being some of the largest remaining areas of lowland rainforest in SE Asia that provide the habitat of many endangered species. In addition, they are large stores of carbon and water and have an important regional economic role, providing forest products and land for settlement and agricultural development. Owing to a lack of awareness and understanding about sustainable land management practices, however, many peatland development projects fail, resulting in serious environmental degradation and impoverishment of local communities.

A number of Southeast Asian and European universities have established a multilateral collaborative research network to address the sustainable management of tropical peatlands through a number of research, education and advisory projects. The research projects aim to improve the understanding of the unique features of the tropical peatlands. In the education projects, the newly acquired knowledge is used to develop university curricula. With the use of innovative educational tools, course materials and training modules that incorporate up-to-date research results and advice on the wise use of

natural resources, are developed and introduced. Finally, in the advisory projects, the newly acquired knowledge is applied. All these activities are done in close consultation with the future end-users: professionals working in tropical peatlands. The network partners actively involve these professionals in all phases of the projects: from the formulation of the research agenda and curriculum development process to the implementation of the results through advisory projects..

This paper describes how the network partners have interacted with the end-users to develop and introduce newly acquired knowledge on the sustainable use of tropical peatlands, with special emphasis on how, during the whole development cycle (research ↔ education ↔ application), monitoring and evaluation have been incorporated.

**Keywords: capacity building, tropical peatlands, management, monitoring, evaluation**

## INTRODUCTION

By the year 2025, the world's population will increase from the current 6 billion to 8 billion and we would need to double our food production. The figures for Asia are even more worrying: Asia covers 24 % of the world's land area, but it has 60 % of the world's population (ICID 2003). For humid Asia, the respective figures are 14 % and 54 % (Keizrul , 2003). To be able to feed the growing world population and to remain competitive in the global economy, countries are developing new areas for food and commodity crop production. As a result, more and more, agriculture is intruding into sensitive eco-systems such as tropical peatlands. These tropical peatlands have global ecological significance, being some of the largest remaining areas of lowland rainforest in SE Asia that provide the habitat of many endangered species. In addition, they are large stores of carbon and water and have an important regional economic role, providing forest products and land for settlement and agricultural development (Rieley et al., 2001). Utilisation of this resource for agriculture or plantation crops requires drainage that, unavoidably, leads to irreversible loss of peat through subsidence, resulting in severe disturbance of the substrate and creating problems for cultivation and peoples' livelihoods. If the specific characteristics of peatlands are taken into consideration, these peatlands can be managed in a sustainable way to ensure a sufficient and continuous supply of raw materials and agricultural products and to maintain biodiversity and environmental conservation, see e.g. the development in Western Johore and Sarawak in Malaysia (Lim Chow Hock, 2003; Ritzema et al., 2003). If, however, the specific characteristics are not taken into consideration, the results can be destructive, as can be sadly demonstrated by the failure of the Mega Rice Project in Central Kalimantan, Indonesia, see e.g. Rieley and Page (2005).

Research on tropical peatlands has, over the years, yield valuable information on its natural functions as a reservoir of biodiversity, carbon stores and hydrologic buffers. Despite the knowledge, many development projects on tropical peatlands have failed through a lack of understanding of the landscape functions of these ecosystems. These failures resulted in a severe degradation, fires and jeopardising their natural functions. In 2000, a number of European and Southeast-Asian research organisations decided to join

hands with the aim to reverse these negative trends and instead to promote wise use of tropical peatlands by integrating biophysical, hydrological and socio-economic data within strategies for sustainable management. They initiated a number of projects in the field of research, education and application. The membership of the consortium changes from project to project, depending on the activities and the required expertise of that specific project. The partners were capable in doing this, as they not only work in research, but also in education & training and in applied research and applications (Table 1).

Table 1 Partners in research, education & training and applications

Organisation	Research	Education	Application
Agency for the Assessment and Application of Technology, Indonesia	●		●
Alterra, Wageningen University and Research Centre, The Netherlands	●	●	●
Can Tho University, Vietnam	●	●	
Department of Irrigation and Drainage, Malaysia			●
Gadjah Mada University, Indonesia	●	●	
Jambi University, Indonesia		●	
Ludwig Maximilians University, Germany	●		●
Malaysian Agricultural Research and Development Institute, Malaysia	●		●
Mulawarman Universities, Indonesia		●	
PS Konsultant, Malaysia			●
Remote Sensing Solutions, Germany	●		●
Universiti Malaysia Sarawak, Malaysia	●	●	
Universiti Sains Malaysia, Malaysia	●	●	
University of Helsinki, Finland	●	●	
University of Leicester, UK	●	●	
University of Nottingham, UK	●	●	
University of Palangka Raya, Indonesia	●	●	
University of Sriwijaya, Indonesia	●	●	
Vapo Oy, Finland	●		●
Wetlands International	●		●

To achieve the twin challenge of increasing demand for agriculture land and at the same time to manage the tropical peatlands in a sustainable way, capacity building plays an essential role. The main objective of capacity building is to improve the quality of decision-making, sector efficiency and managerial performance in the planning and implementation of sector programmes and projects (IHE-UNDP, 1991). For tropical peatlands, this can be obtained by improving knowledge on the functions and characteristics of these peatlands so that more sustainable management strategies can be developed and implemented. Capacity

building should focus on the following elements (Ritzema and Wolters, 2001):

- Creating an enabling environment with appropriate policy and legal frameworks;
- Institutional development, including community participation, and;
- Human resources development and strengthening of management systems.

In this respect, capacity building is as much a process as a product (Kay and Terwisscha van Scheltinga, 2003). This paper discusses the role of monitoring and evaluation to assess the capacity building in several research, education and advisory projects for the wise use of peatlands in the tropics (Figure 1). The research projects address issues that are relevant for finding a balance between livelihood (the challenge to increase food production) and resources (the challenge to manage the tropical peatlands in a sustainable way). In the education projects, the newly acquired research knowledge is used to develop and implement teaching materials. In the advisory projects the focus is on applying this knowledge. All projects have activities focusing on the above-mentioned capacity building elements. Capacity building is a complicated process as many stakeholders, organisations as well as individuals are involved, i.e.:

- Research organisations and universities;
- International, national and regional government organisations, acting as the principal funding agencies, but also the users of the end-products;
- Private companies: both as co-developers of the knowledge (as they bring in their experiences) and users of the end products;
- NGO's: also as co-developers of the knowledge (as they bring in their experiences) and users of the products.

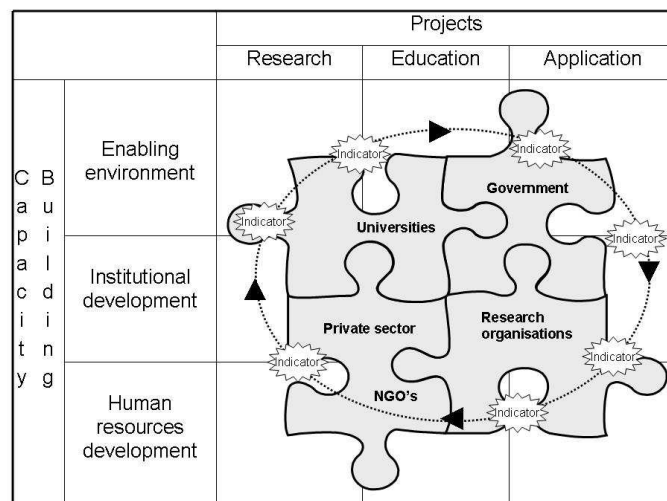


Figure 1 The role of indicators in the monitoring and evaluation process (.....▶) for capacity building: finding a balance between (i) an enabling environment; (ii) institutional development and; (iii) human resources development in research, education and advisory projects to address the wise use of peatlands.

The three elements of capacity building have been addresses by the following activities: (i) promotion of partnerships; (ii) involvement of stakeholders; (iii) integration of the various disciplines; (iv) acquiring new knowledge; (v) dissemination of knowledge, and; (vi) implementation of the newly acquired knowledge and skills. To assess whether these elements have been addressed successfully, a number of indicators were used (Table 2). In the following sections is described how this was done and which indicators were used to assess whether these objectives were reached.

Table 2 Capacity-building indicators for the main project activities

Indicator	activity				
	partnerships	new knowledge	integration	stakeholders	dissemination
Books		x	x	x	x
Collaborative research					x
Conference presentations					
Decision support system	x			x	
Edited conference proceedings				x	x
External funded projects	x	x	x	x	x
Guest-lectures					x
Guidelines / handbooks		x	x	x	x
Joint action			x	x	x
Joint studies and consultancies	x	x	x	x	x
Market survey			x	x	
Training modules					x
MSc's and PhD's	x	x			x
Papers published in International Journals		x			x
Partner Meetings	x				
Post-graduate course		x		x	x
Project evaluation	x	x	x	x	x
Website	x	x	x	x	x
Workshops/seminars/symposia	x	x	x	x	x

## CAPACITY BUILDING THROUGH JOINT RESEARCH

Five years ago, twelve European and Southeast-Asian research organisations (Table 1) initiated the multi-disciplinary research project STRAPEAT (Wösten, 2005). This 3-year project (December 2001 – November 2004), which was supported by the EU through the INCO-DEV programme, was a follow-up of other EU-INCO funded projects. Compared to the previous projects, which were more focussed on the natural resource functions, the scope of the STRAPEAT project was wider: it included more disciplines and not only focused on doing research to better understand these complicated ecosystems, but sought actively to implement strategies for practical use in critical peatland areas in Borneo. Capacity building was an integral part of the activities. Indicators to assess the effects of these capacity-building activities are summarized in Table 2 and discussed in the following paragraphs.

### *Human resources development: Increased knowledge on the natural resource functions*

At the start of the project, two workshops for the project partners and representatives of the local research organisations were organised, one in Palangka Raya, Kalimantan, Indonesia and one in Sibuluh, Sarawak, Malaysia. During the workshops, 12 status reports, covering all disciplines involved in the management of tropical peatlands, were presented and based on these reports, the research agenda for the three-project was agreed upon by the project partners and the local research organisations (STRAPEAT, 2002). Project partner meetings were organised every following year to review the ongoing research activities, to reach internal consistency, to update the research agenda, to integrate the various disciplines and to exchange information between partners and the local stakeholders. To enhance the exchange of information, a web site was developed ([www.strapeat.alterra.nl](http://www.strapeat.alterra.nl)). The main functions of the website are: (i) to give background information of the project and the research partners, (ii) to present news, and (iii) to make available the project results through downloadable reports and presentations. On the opening page of the website, the number of visitors is automatically updated, indicating the relevance of the site. To train partners and at the same time to guarantee that the research is of academic quality, the partners embedded research activities in their formal education system. This resulted, among others, in three completed MSc's and four completed PhD's. To present the project results to the international research community and to discuss the results with them, an international symposium and workshop on Tropical Peatland was organised (Rieley, 2006). That the research findings are of high academic quality is also illustrated by the number of presentations and papers produced by the project partners (see Enabling environment).

### *Institutional development: participation of stakeholders in setting the research agenda and dissemination of the results ("wise use principles")*

A series of annual seminars/workshops with local stakeholders was organised in Southeast Asia to inform stakeholders on the research findings, to interact with them on the research agenda, etc. To mark the end of the project, presentations of key outputs were made in a series of seminars/workshops held in Kuching, Sarawak, Malaysia, Palangka Raya, Central Kalimantan and Jakarta, Indonesia. Participants, both from the private and public section, agreed upon a 'Statement' on "Wise Use of Peatlands in Central Kalimantan, Indonesia" (Wösten, 2005). This statement was distributed widely, among others, through the website.

Table 3 Indicators for the capacity building activities

<b>Indicator</b>	<b>Research</b>	<b>Education</b>	<b>Advisory</b>
Collaborative research		4	2
Conference presentations	133	2	4
Decision support system		1	
Edited conference proceedings	1		
External funded projects	2	2	3
Guest-lectures		12	
Guidelines / handbooks	3		3
Joint action/studies and consultancies	1		5
Market survey		2	
MSc's and PhD's	7		
Papers published in International Journals	23		2
Partner Meetings	7	5	
Post-graduate course		1 (+ 1)	
Project evaluations	2	1	3
Training Modules		6	
Website	2	1	
Workshops/seminars/symposium	6	2	5

Contact with funding agency was not only maintained through reports, but also a briefing was organised at the EU in Brussels to inform the EU, the main funding agency, of the progress and activities and the synergy with the education and advisory projects. That the EU selected the project to illustrate international cooperation for sustainable development ([http://ec.europa.eu/research/leaflets/inco/article\\_2991\\_en.html](http://ec.europa.eu/research/leaflets/inco/article_2991_en.html)) shows that the activities are highly appreciated by the funding agency.

*Enabling environment: dissemination of the wise use principles to all stakeholders*

Partner meetings were often held in conjunction with other symposia and/or workshops, in Europe, see e.g. Päivänen (2004) and in Southeast Asia, e.g. Rieley (2006). This allowed the partners to present and discuss their findings with other scientists interested in tropical peatlands. This has resulted in a huge number of conference presentations and papers in both conference proceedings as well as in international journals (Wösten, 2005).

The outputs were the results of working together as a group for some years: partners were clearly stimulated by the internal consistency as well as openness for the ideas of other partners and stakeholders. In the follow-up project, RESTORPEAT ([www.restorpeat.alterra.nl](http://www.restorpeat.alterra.nl)), the capacity building activities are enhanced even further, through the following actions/activities:

- Extension of the partnership with a partner from the private sector (Vapo Oy, Finland) and a Vietnamese University (Can Tho);
- Creation of stakeholder platforms and skill transfer to stakeholders through

- partnership with local governments and local people;
- Dissemination of project results, not only to the scientific community, but also to a whole range of other stakeholders ranging from international and national governmental organisations to farmer's and landowner's organisations.

RESTORPEAT is again co-funded by the EU. Competition in international research funded is stiff and only a small percentage of the proposals is accepted. RESTORPEAT being the third successive project clearly illustrates its relevance.

### **CAPACITY BUILDING THROUGH JOINT EDUCATION**

The partners in research use the newly acquired research knowledge to update their education programmes. Four of the partners, i.e. the Universities of Leicester, Palangka Raya, Sarawak and Wageningen, joint forces in the PEATWISE project (Ritzema et al., 2004), supported by the EU, through its Asia-Link programme. The Asia-Link Programme is an initiative by the European Commission to promote regional and multilateral networking between higher education institutions in Europe and developing countries in Asia. The programme aims to promote the creation of new partnerships and new sustainable links between European and Asian higher education institutions, and to reinforce existing partnerships. The project covers the entire sequence of curriculum development, the production of educational tools and course materials and the training of staff in the dissemination of the knowledge. To allow for a correct scientific development of the project within the budget framework, a phased approach was adopted ([www.peatwise.alterra.nl](http://www.peatwise.alterra.nl)):

- Inception: (i) Market assessment; (ii) Inventory of existing curricula and courses and (iii) Inventory of existing educational infrastructure.
- Development of the curriculum: (i) Ecology and natural sciences; (ii) Water resources and hydrology; (iii) Soil and land use (agriculture, forestry etc); (iv) Human dimensions and resource economics, and (iv) GIS and Remote Sensing.
- Implementation: (i) Marketing; (ii) Training, and (iii) Testing.

Compare to the research projects, the focus is more on the human resources development component of capacity building, however, the other two elements are also addressed (Table 3). In the inception phase, the Indonesian and Malaysian partners conducted market surveys to assess the needs of the target group, i.e. professionals dealing with tropical peatlands in planning, implementation and evaluation and monitoring. The inception phase was concluded by a two-day workshop in Kuching, Sarawak, in which the partners agreed upon a joint-framework for the curriculum development. It was decided to develop education packages on the sustainable management of tropical peatland consisting of six modules for post-graduate student on their way to an MSc diploma. The development of the modules for the curriculum is a joint activity of the four partners: for each module, one partner has the lead, but all partners contribute to the development. Totally about 22 Staff members are involved in the development. Partners strengthen each other capacity by

cooperating close together, e.g. in (i) collaborative research programmes at each others university for cooperation in the development of modules and (ii) partners, not only from the PEATWISE project but also from the STRAPEAT and RESTORPEAT projects, act as guest lectures in each other courses. Each participating University will embed these modules at the appropriate level in their own academic system. A workshop on curriculum development was organised at Leicester University, to discuss how ITC can be used in the curriculum. Depending on the needs and status of each partner, the starting point can vary: no ICT, only hardcopies → use of digital tools, like MS PowerPoint → CD-Rom → digital courses/local server → internet based materials → distance learning.

During the curriculum development process, feedback with the stakeholders was enhanced by organising try-out courses and workshops to review the curriculum development and contents of the modules. The results are promising: in January 2006, UNIMAS started the first full-scale graduate diploma programme: a one-year post-graduate course for students with a Bachelor degree and working in peatland management. The course, which consists of six modules, is designed for professionals working for public and private organisations dealing with peatland management. Because all students follow the course next to their regular job, the programme is organised in the weekend: from Friday to Sunday, block wise per module. The number of students varies between 8 and 12 depending on the module. Like in the development phase, partners assist UNIMAS with the implementation: they provide teaching materials and act as guest lecturers. At present most, course material is available in MS PowerPoint presentations, in the second phase of the project these materials will be further developed in distance learning tools. All modules are evaluated by the students and these evaluations are used to improve and further develop the course materials. One year after the start of the project, a monitoring mission of the EU rated the project relevance, efficiency and impact as good to very good, although more attention should be paid to the potential sustainability.

In 2005, a new project on integrated water resource management was initiated to enhance the technical proficiency of Indonesian University staff at Jambi (West Sumatra) and Mulawarman (East Kalimantan) Universities by transmitting methodologies and knowledge on integrated water resources management (IWRM) at river basin scale ([www.air-co.org](http://www.air-co.org)). This project aims to:

1. Upgrade and enhance skills and expertise of postgraduate students and university staff on hydrological and ecological functioning of tropical water and lowland resources at the river basin scale and as a component of an IWRM;
2. Strengthen networks of excellence within Asia (Jambi and Mulawarman Universities, Indonesia) and Europe (Wageningen University and Research Centre, The Netherlands and University of Leicester, U.K.) through scientific cooperation and exchange of experience built on existing projects;
3. Promote student and teacher mobility and portability of skills and academic credentials;
4. Enhance a core of skilled scientists to keep abreast of cutting-edge research conducted on integrated water resources management;
5. Promote the use of Remote Sensing techniques as a component for research and teaching modules;

6. Develop innovative educational methods and novel technologies (distance e-learning, virtual library, etc.) to improve quality of teaching and learning, and;
7. Strengthen the country's institutional capacity to identify and implement efficient management of river basins in a framework .

### **CAPACITY BUILDING FOR APPLICATION BY DECISION-MAKERS AND OTHER STAKEHOLDERS**

Training people, however, does not guarantee that they are able to apply their newly acquired knowledge in their daily work. Therefore, the partners are also involved in the third element in capacity building, creating an enabling environment by assisting the stakeholders with this implementation through:

- Joint studies and consultancies to assist integrated agricultural development projects on peatlands with the implementation of the wise use principles. For these activities, the partnerships have been enlarged to include government organisations, NGO's and private consultant firms;
- Preparation of guidelines and handbooks to provide sufficient information an insight to enable stakeholders to understand the tropical peat ecosystem so that they can anticipate problems before they arise and are able to put principles of wise use in to effect;
- Development of a decision support system to visualize strategies for sustainable water management on tropical peatland.

The activities are directly funded by stakeholders agencies: this clearly illustrates the need for assistance and appreciation of the knowledge and experiences of the partners. In these projects, the direct and frequent feedback with the clients is a prerequisite for success. This feedback includes a continuous evaluation and monitoring through meetings with clients and other stakeholders, reports, presentations etc. Capacity building activities are focussed on the third element (enabling environment), but also addresses the human resources and institutional development elements (Table3), as can be illustrated by the outputs:

- Recommendations for the management of peat soils in Western Johore, Peninsular Malaysia: a multi-disciplinary collaboration between WUR, the Malaysian Department of Irrigation and Drainage, Department of Agriculture and Agricultural Research and Development Institute (LAWOO, 1996). These recommendations were also published in international journals (Ritzema et al., 1998; Wösten et al., 1997);
- Publication on the Wise Use of Tropical Peatlands with the focus on Southeast Asia. This publication provides information and insights on tropical peat and peatland to enable stakeholders to understand this ecosystem and to put principles of wise use into effect (Rieley and Page, 2005).
- Handbook for Environmental Impact Assessment for the developments on peatlands: a UNIMAS-STRAPEAT-NREB jointly authored handbook describing the potential adverse impacts of development on peatlands and recommendation of possible mitigation measures to address these impacts (Murtedza, 2004).

- Water Management Guidelines for Agricultural Development in Lowland Peat Swamps of Sarawak: a multi-disciplinary collaboration between WUR and Sarawak Government organisations resulted in guidelines on the best practices for planning, assessment, design, implementation and management of water management systems for agricultural activities in the lowland peat swamps of Sarawak (DID, 2001). The activities included a seminar to discuss the guidelines with the end-users (Chew and Sim, 2003), presentations in international conferences (e.g. Alterra-ILRI, 2004; ICID, 2002; Tan and Ritzema, 2003) and publications in International Journals (e.g. Wösten and Ritzema 2001).
- Demo of an internet-based decision support system to visualize strategies for sustainable water management on tropical peatland ([www.peatwise-terra.nl](http://www.peatwise-terra.nl)). (Veltman, 2006).
- Recommendations on the Air Hitam Laut river basin management based on research findings, community-based planning and workshops (Silvius, 2005). Collaborative research on modelling was one of the activities in this project.

## CONCLUSIONS

Five years ago, a number of Southeast Asian and European research organisations established a multilateral collaborative research network to address the sustainable management of tropical peatlands through a number of research, education and advisory projects. The main challenge is to achieve increasing food production and at the same time to manage the tropical peatlands in a sustainable way. In this process, capacity building plays an essential role. In this capacity building process, many stakeholders, organisations and individuals, are involved, i.e. research organisations, universities, international, national and regional government organisations, private companies, NGO's and all individuals working or living in these areas. Capacity building focuses on three elements (i) creating an enabling environment; (ii) institutional development, including community participation, and; (iii) human resources development and strengthening of management systems. In the projects, these three elements are addressed through a number of activities. Firstly, cooperation in research is promoted with the aim to get a better understanding of the unique features of the tropical peatlands and to develop principles of wise use. Secondly, this newly acquired research knowledge is used to develop new university curricula to train professional working in the management of these tropical peatlands. Finally, to assist these professional with applying their newly acquainted knowledge, guidelines, including decision support systems, for the wise use of tropical peatland are developed. To ensure that these capacity-building activities are done efficiently and effectively a continuous system of monitoring and evaluation is incorporated in the projects.

A number of indicators was used to assess the impact of the project activities (Table 3). These indicators address a whole range of activities during the complete project cycle: from the project formulation to the implementation of the products. The indicators “*External funded projects*” and “*Project evaluations*” address the relation with the funding agency:

most projects are funded through international or national tendering: competition is severe, thus only consortiums with highly qualified staff and a proven track-record succeed in obtaining funding. The indicators “*Collaborative research*”, “*Joint action/studies and consultancies*”, “*Partner meetings*” and “*Website*” address the collaboration between the partners. As such, the projects demonstrated the big advantage of continuing a proven successful collaboration between partners, both in Europe and Southeast Asia, of different background, expertise and focus. Since partners are used to work together as a group for some years, internal consistency, openness for the ideas of other partners as well as understanding of each others’, sometimes conflicting, interests, and working together towards multi-disciplinary, wise use strategies is stimulating. The indicators “*Collaborative research*”, “*MSc’s and PhD’s*”, “*Joint action/studies and consultancies*”, “*Partner meetings*” address the human development component. The indicators “*Decision support system*”, “*Joint action/studies and consultancies*”, “*Market survey*”, “*Website*” and “*Workshops/seminars/symposium*” address the feedback with the end-users. The indicators “*Conference presentations*”, “*Edited conference proceedings*”, “*Guest-lectures*”, “*Guidelines / handbooks*”, “*Papers published in International Journals*” address the dissemination of the research findings to a wider audience in international forum. The indicators “*Decision support system*”, “*Guidelines / handbooks*”, “*Post-graduate course*”, “*Training Modules*” address the translation of the research knowledge in curricula, guidelines and handbooks to provide sufficient information and insight to enable stakeholders to understand these tropical peatland ecosystems and to put principles of wise use into effect before problems arise.

These indicators clearly show that the project partners actively involve the stakeholders in all phases of the projects: from the formulation of the research agenda and curriculum development process to the implementation of the results through advisory projects. The research partners also benefit from this interaction: the expert knowledge of the stakeholders is used to update guidelines and hand books. The same applies for the human resources development activities: feedback from students on the newly developed curriculum, etc. All these activities bring us closer to our ultimate aim: the wise use of the tropical peatlands in Southeast Asia. We should realise, however, that there is still a long way to go and we should remember that capacity building is as much a process as a product and that only by cooperation between all stakeholders, even stakeholders with conflicting interests, sustainable land management practices can be achieved.

### **Lessons learned**

- Capacity building needs a clear focus (in this case “*Sustainable management of tropical peatlands*”)
- Capacity building is not a stand-alone activity but an integral part of each and every project
- Capacity building is a long-term process ⇔ projects are short-term
- Capacity building includes many activities
- Indicators are a good tool for monitoring and evaluation
- Indicators should be defined for each activity
- Activities can have the same indicators
- Indicators should be defined at the start of a project (Logical Framework)

- M&E for Capacity building extends beyond the project life.

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