Regional conference on
Value of the Thanlwin/Salween River:
Ecosystem Resources Conservation and Management
Yangon, Myanmar
28–29 May 2013

Co-organized by
Renewable Energy Association Myanmar (REAM)
Towards Ecological Recovery & Regional Alliance (TERRA)
Mekong Energy and Ecology Network (MEE Net)
Regional conference on

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Supporters:
Interchurch Committee for Development Cooperation (ICCO)
Swedish Society for Nature Conservation (SSNC)

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Introduction

- The Thanlwin River (‘Salween’ in Thai, ‘Nu’ in Chinese and ‘Gyalmo Ngulchu’ in Tibetan) is among Myanmar’s main lifelines. The Thanlwin might not be of paramount importance compared to the Ayeyarwady which, together with its major tributary the Chindwin, drains approximately 60 per cent of the country’s total land area. But the Thanlwin has its own characteristics which deserve higher priority.

- The Thanlwin originates in the Himalayan plateau, flowing through the Chinese province of Yunnan, enters Myanmar territory in Shan State, forms the Thai-Myanmar border, re-enters Myanmar territory passing through the two ethnic states of the Karenni and Karen and empties into the Andaman Sea (Motama Bay) at the capital of the ethnic Mon state (Mawlamyine).

- The Thanlwin is also situated in one of the most important of the world’s regions with respect to ecological and ethno-cultural diversity. It is little known to the general public in the region and the world that the Thanlwin is the world’s 26th longest river (with a length of nearly 3,000 km) and Southeast Asia’s last great river to remain free-flowing.

- Last but not least, unlike other international rivers, the Thanlwin has no supra-national body/authority (like the Mekong River Commission) to coordinate/regulate the national policies of 3 riparian countries with respect to utilization of the river. Indeed, these countries tend to look at it as a source of revenue, overlooking (or even disregarding) the transboundary implications associated with mega development projects designed to benefit from the river. China’s plan to revive a score of hydropower projects on the Nu River without taking into account the potential impacts on the countries downstream is a case in point.
The workshop on the value of the Thanlwin/Salween River for inland and coastal ecosystems and local livelihoods is proposed to address a number of critical needs/problems facing river management: insufficiencies of knowledge and information flows necessary for national-level planning on river management, limited civil society participation, and the absence of regional/inter-governmental regulation/cooperation regarding river resource utilization.

Objectives:

1. To bring together research-based, academic information relevant to examining the social and ecological value of the Thanlwin River and its ecosystem.
2. To identify priority academic areas/issues associated with questions regarding ecosystem conservation/management and development impacts which require further studies, and to explore the possibility of research cooperation to address these questions.
3. To provide a forum for exchange among concerned academic institutions and professional researchers from within Myanmar and between these entities and those from outside of the country regarding relevant information and experience to address the transboundary implications of the management and utilization of the common natural resource represented by the Thanlwin/Salween River.

Expected outputs

1. Available information regarding the value of Thanlwin River is compiled, enabling participating individuals/organizations to collectively examine the current state of knowledge, and to identify areas/issues requiring further studies.
2. Potential development impacts are analyzed, and possible solutions are outlined.
3. Participating individuals/organizations recognize the importance of the transboundary implications associated with the future utilization of the Thanlwin River and the need for preventive solutions.

Key issues/components:

1. Coastal ecosystems of the Thanlwin River (sea front, river mouth).
2. Inland ecosystems along the Thanlwin River bank on both the Myanmar and Thailand sides.
3. Local livelihoods (including those of the ethnic communities) along the Thanlwin River and its main tributaries in both Myanmar and Thailand.
4. Experiences from the Mekong River regarding utilization and joint management.
5. Other issues of relevance: development impact; transboundary questions; energy policy considerations for Thailand and Myanmar
6. Field exposure to the coastal area in Mon State (Mawlamyine area).

Participants:

Mawlamyine University, Pathein University; Yangon University, Fisheries Department, Forestry Department, Individual Professionals, Professionals, Representatives of civil society organizations and Media
# Workshop agenda

**Value of the Thanlwin/Salween River:**

**Ecosystem Resources Conservation and Management**

28–29 May 2013

## 28 May 2013

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| 08.40 – 09.20| **Opening Keynote addresses**                                                              | **HE U Thein Lwin**, Secretary of the Natural Resources Conservation and Management Committee of the Parliament of the Union of Myanmar  
**Mr. Veerawat Dheeraprasart**, Chair, National Network of Natural Resources and Environmental Organizations, Thailand |
| 09.20 – 09.40| **Overview of the seminar and introduction of participants**                              | **U Aung Myint**, REAM; **Mr. Srisuwan Kuankachorn**, TERRA                  |
| 09.40 – 10.10| **1. Ecology and livelihood:**                                                             |                                                                              |
| 10.10 – 10.40| 1.1 - Case studies from China                                                              | **Dr. Yu Xiaogang**, Green Watershed, China                                  |
|              | 1.2 - Case studies from particular ethnic states of Myanmar                               | **Mr. Montree Chantawong**, TERRA                                            |
| 10.40 – 11.00| **COFFEE BREAK**                                                                          |                                                                              |
| 11.00 – 12.00| **1.3 - Salween Studies, Thailand**                                                        | **Mr. Pairote Phanaphraisakun**, community researcher, and **Ms. Luntharimar Longcharoen**, TERRA |
| 12.00 – 13.00| **LUNCH**                                                                                 |                                                                              |
| 13.00 – 13.30| **1.4 - Potential impacts of damming the Thanlwin River in Myanmar**                      | **Prof. Dr. Maung Maung Aye**                                                |
| 13.30 – 13.50| **1.5 - Vegetational study of Thanlwin River Basin at Kunlong Hydropower Project**        | **U Nyo Maung**, Retired Professor (Botany), Mandalay University, and **Dr. Ei Ei Phyoe**, Botanist |
| 13.50 – 14.20| **1.6 - Thanlwin River mouth sedimentation process**                                       | **Dr. Tun Tun Zaw** and **Dr. Day Wa Aung**                                
**Department of Geology, University of Mawlamyine** |
<p>| 14.20 – 14.50| <strong>1.7 - Biodiversity of the Thanlwin/Salween River: Species lists of plankton and nekton from Kunlon area, Shan State, Myanmar</strong> | <strong>U Zau Lunn</strong>, <strong>Biodiversity and Nature Conservation Association (BANCA)</strong>, and <strong>U Saw Han Shein</strong>, REAM |
| 14.50 – 15.00| <strong>COFFEE BREAK</strong>                                                                          |                                                                              |
| 15.00 – 15.30| <strong>1.8 - Prawn and shrimp resources of the Thanlwin/Salween River mouth and adjacent waters</strong> | <strong>Dr. Htay Aung</strong>, Rector, University of Mawlamyine, and <strong>Dr. Than Than Soe</strong>, Assistant Lecturer, Department of Zoology, University of Mawlamyine |
| 15.30 – 16.00| <strong>1.9 - Let the River Thanlwin flow</strong>                                                      | <strong>U Saw Moe Myint</strong>, Mining Engineer                                         |</p>
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<td>1.10 - Reviews of research works on the Thanlwin River estuary and adjacent waters</td>
<td><em>U Soe Htun, Head of Department of Marine Science, and Dr. Tint Swe, Department of Marine Science, Mawlamyine University</em></td>
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<td>- River Resource &amp; its Ecosystem issue</td>
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<td>- Socioeconomic issue</td>
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<td><em>Dr. Yu Xiaogang, Green Watershed, China</em></td>
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<td><strong>3. Some considerations on solutions</strong></td>
<td><em>Mr. Witoon Permpongsacharoen, MEENet</em></td>
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<td>3.1 - Thailand's and regional current energy sector and alternative policy framework</td>
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<td>3.3 - Transboundary environmental assessment in utilizing international water in the Chinese context</td>
<td><em>Dr. Bian Yongmin, University of International Business and Economics, Beijing</em></td>
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<td><strong>Roundtable: issues/areas of future cooperation</strong></td>
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<td>14.00 – 15.30</td>
<td><strong>General Discussion by focusing the following issues</strong></td>
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<td>- Thanlwin River Ecosystem Resources</td>
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<td>15.50 – 16.30</td>
<td>Wrap-up</td>
<td><em>U Aung Myint, REAM and Mr. Witoon Permpongsacharoen, MEE Net</em></td>
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<td>16.30 – 17.00</td>
<td>Closing addresses</td>
<td><em>Mr. Srisuwan Kuankachorn, TERRA and U Latt, Chairman, REAM</em></td>
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This regional conference on the *Value of the Thanlwin/Salween River: Ecosystem Resource Conservation and Management* was proposed by TERRA and jointly organized and hosted by REAM/TERRA and MEE Net to address a number of critical needs/problems that are currently threatening a deterioration of the river resource. Present plans and management activities with limited knowledge and information will produce huge impacts on society in the future. Resource exploitation without proper regional/intergovernmental regulation, coordination and cooperation will destroy a valuable international river resource.

The conference was opened by HE *U Thein Lwin*, Secretary of the Natural Resources Conservation and Management Committee of the Parliament of the Union of Myanmar, and *Mr. Veerawat Dheeraprasart*, Chair, National Network of Natural Resources and Environmental Organizations of Thailand. Their keynote speeches addressed expectations of the value of the Thanlwin River and future improvements from the sharing knowledge and experience among participants including relevant individuals and organizations.

Introductory speeches by *Mr. Srisuwan Kuankachorn* of TERRA and *U Aung Myint* of REAM explained the objectives and expected outputs of the conference, which are to conduct collective research, share information, enhance people’s participation and identify priority technical areas/issues associated with current transboundary implications of the management and utilization of the common natural resource of the Thanlwin/Salween River.

The following are discussion points from the conference on the Value of the Thanlwin/Salween River: Ecosystem Resource Conservation & Management held on 28 and 29 May 2013 at Yangon, Myanmar.

The conference was successful in securing the participation of parliamentarians, government ministry representatives, academics from Yangon, Mawlamyine and Pathein universities, civil society representatives, NGO staff and private entrepreneurs from the Myanmar side, together with academics and professionals from Thailand and China. A detailed participant list is attached.

Resource persons from China, Thailand and Myanmar made presentations in accordance with the attached agenda whose three main sections focused on: 1) Ecology & Livelihood; 2) Challenges; and 3) Solutions.
Presentations from China

Presentations by Chinese academics raised the following important points:
- Seismic risk (geological information)
- Geological fault lines
- Earthquake records
- Climate change impacts
- Chinese practice of comprehensive reporting to higher authorities
- Government guidelines to proceed only with more thorough research
- Data on increased frequency of earthquakes caused by dams
- Noticeable findings on the ability of dams to trigger earthquakes
- Information on the need to avoid big dam construction in earthquake zones
- Importance of geological data
- Marginality of 8 Richter Scale and danger of low scale with high frequency
- Lack of trans-boundary law in China
- International Court of Justice involvement
- Launch of the Chinese EIA Law in 2003
- Current Chinese Government attempts to open EIA to more public participation
- Importance of transparent and enforceable laws and legal frameworks
- Trans-boundary international assessment experiences of France and Spain as a good examples
- International Court of Justice compensation ruling in French-Spanish transboundary case
- Practice of double standards by different parties in Chinese foreign investment depending on regulations and standards of the host country (policies, laws, regulations and government procedures)
- Importance of information in this workshop indicated by participation of the Human Rights Commission office
- Successful ecotourism in the Nu river area in China due to the value of natural beauty
- Impact of giant dams on decline of fisheries, salt water penetration of estuaries, erosion, flooding, deterioration of water quality, relocation of ethnic inhabitants (extinction of the Yin Talai minority), outstanding biodiversity
- Lack of effective transparency
- Exploitation of hydropower for export income, rather than for the benefit of local people

Presentations from Myanmar

- Presentation by geography professors urging more research on resources appraisal, resource management with priorities and process, ecosystem studies, ethnic/cultural issues, human dimension & environmental effects, environmental knowledge and people's participation
- The length and international nature of the Thanlwin demands recognition of its ecological value in conservation and management
- Information on the use by the extremely poor of the watershed area for subsistence must be disseminated to the authorities and the public
- Joint action among universities and with the Thanlwin River Commission should be encouraged
- Secondary green plantations by people and government
- Deterioration of watershed areas as a result of ‘slash and burn’ agricultural practices
- Ecologically important plant species not only play an environmental conservation role but are also useful indicators for economic development, for example of the fern species Equisetum
- Most biodiversity is not yet explored or recorded and the value of the ecosystem is not understood
- Management should be supported by the establishment of Conservation Funds and Socioeconomic Development Funds through EIAs
- Thai lessons from dam construction must be observed in detail in the consideration of future Myanmar dam projects
- Information from a Yangon University Archaeology Department representative on the joint international survey with the Korean KIOCA group regarding grassroot livelihoods and traditional culture conservation, with audience comments
- The Marine Science Department, Mawlameyine University, presented all research by the Department since 1973, including comprehensive research on Thanlwin river ecosystem resources (seaweeds, mangroves, fisheries, estuarine ecosystem, oceanographic data, geographic surveys, geological findings etc.), to be made available to all policy makers, researchers and developers who want to conserve and manage river ecosystem resources
- Research presented by the Geography Department on physical and chemical properties of sediments, contributing to the scientific study of river mouth topography, water regime and morphological changes which can suffer huge impacts when the river flows are dramatically changed by dams
- Possible effect of dams on sedimentation processes as a major concern due to its negative impact on inhabitants’ livelihood and security
- Significant decrease in income from fisheries
- Presentations by Mawlamyine University and BANCA (local NGO) on key intangible ecosystem resources, plankton and nutrients (biological primary producers of the ecosystem food-web) highlighting the importance of these microorganisms and their direct and indirect role on the socio-economic situation
- Records on benthic fauna including peri-plankton (stuck to rocks or substrate) and their relation to the Thanlwin river mouth ecosystem as food for fisheries
- Watershed deforestation and topsoil erosion as a threat to water quality changes and the ecological relation of microorganism components in the food chain
- Solution in ecologically friendly ecotourism requiring follow up research in appropriate promotion

Presentations and outcomes from Thailand
- Lessons for Myanmar from current power planning practices in Thailand
- Off-grid policy advantages
- Strategic Energy Mix and Myanmar: 70% hydropower component in country PDP
- Energy consumption ratio: 42% by households; 32% by industry; 40% by commerce
- Need to improve grid cost of US$4.13 per unit (35k) by studying local and international contexts
- Visualized demand of 1,500kWh vs generation of 3,000kWh
- IPP/SPP/VSPP practices
- Mini-grid potential for Myanmar based on Thai practice
- Application of Energy Efficiency and Conservation (EE&C) in power sector improvement and reform process
- Criticality of Big Dam issue in the trade-off between environment and electricity (energy) and the lessons to be learned from the Thai experience for the Myanmar process on Country Energy Policy and Energy Development Planning.
- Alarming information from Thailand on Hat Gyi dam
- Highlights of experience in ecosystem destruction in the Vietnam Mekong Delta
- 1,360MW Hat Gyi hydropower project with 3% share by one Myanmar company (IGOEC) aims to export power to Thailand with definite decreases in the sedimentation process and natural water levels; EIA by both countries does not present trans-boundary impacts to the public with the need for a more strategic environmental assessment to be carried out from the community level to the academic level
- Water diversion project under consideration
Key discussion points and conclusions:

- The National Seminar in Naypyidaw on the Energy, Economy and Environment mixture should elaborate on the presentations from Thailand on the importance of the value of ecosystems.
- The ecologically related issues of climate change, hydrological management and application of channelization technology are important in river resource conservation and management. Essential requirements of high technology together with high investment are neglected in implementation.
- A survey of who wins and who loses from large projects on the Thanlwin River was demanded by participants.
- The Thai community presentation showed particular negative impacts of large river projects on resource depletion through the example of the loss of edible micro-algae species that was previously collected from river banks in traditional income generation.
- The potential impact on sedimentation, water levels, changes in inundated farm areas, biodiversity and fishery losses, droughts/floods, river bank erosion and changes in river morphology will affect the socio-economic status of inhabitants.
- CSOs, NGOs and CBOs have an essential role in mobilizing and enhancing participation in assessments, surveys and research with governments, academic institutions and international organizations.
- Big dam construction risks earthquakes in China.
- The Hat Gyi Dam site 100 km upstream from the mouth of the Thanlwin is close enough to impact the river mouth ecosystem.
- The results of a TERRA study on the communities on the banks of the Salween were observed.
- TERRA intends to set out the appropriate joint functions in research, information exchange and further studies of the Marine Science Department of Mawlamyine University and Thai universities.
- Socio-cultural issues of the minorities who may be affected by impacts should be emphasized.
- Information on plans for the Hat Gyi Dam and public hearings is urgently required.
- A bilateral trans-boundary EIA is necessary.
- December 2013 meeting is to be arranged by MEE Net and REAM.
- Discussion on future Myanmar energy demand should be focused on real energy and electricity demand in light of the problem of excessive focus on demand measures in Thailand and the current burden of electricity expenditure.
- Green option of ‘small and many’ projects should be considered.
- Marine Science Department of Mawlamyine University proposed joint research, surveys and publications as follow-up activities to the conference.
Field Trip to Kyaikkami, Sat Se, Bilu Gyun and Mawlamyine University

**Kyaikkami**: a small town situated at the tip of the Thanlwin River mouth, facing Martaban Bay. Bay-net fishing gear industries and off-shore fishing boats were observed. Post-harvest processing could not be observed because of the season (rain). The fishery port became open due to the destruction of previously protected mangroves. Villagers think that coastal erosion and decreases in catch and size of common species occurred after land reclamation activities on Bilu Gyun Island.

**Sat Se beach and Damin Seik fishing village**: Study tour of the Marine Science Station of the Marine Science Department. Visit to Damin Seik fishing village interviews with fishermen. The main fishing gear of that area is bag-net.

**Bilu Gyun Island [Moon Star Island]**: Boat tour along the Thanlwin River mouth and confluence of the Ataran and Gyaing rivers. Visit to a village on Bilu Gyun. In a discussion with the village elders and community, the tour group explained the objectives of the trip and the potential impacts of upstream dam construction on the Thanlwin. Villagers had no knowledge of the plans or possible impacts. Their main worry is increasing salt water intrusion into their paddies. Their main livelihood of agriculture depends on freshwater from the Thanlwin and seasonal riverbank flooding is an important ecosystem resource. Their secondary livelihood of fishery is declining in terms of catch and fish varieties. Supplies of fresh water do not satisfy domestic water needs. There is a joint Thai-Myanmar project for coastal area construction on Bilu Gyun but no details were observed.

**Mawlamyine University**: A meeting was held and attended by all professors and heads of department of Marine Science, Botany, Zoology, Geography, Geology, Physics, Chemistry, Burmese, English, Psychology and Mathematics. The Rector of the University, Dr. Htay Aung, gave an introduction and welcome speech, expressing the value of the Thanlwin River and it ecosystem resources. The following points were recorded.

A seawater intrusion profile study at the mouth of the Thanlwin is essential to understand the ecological changes in the water regime of the estuarine fishery area. Scientific studies on mangrove vegetation had been done, but more observations on mangrove ecosystem changes were needed to understand more about the river resource. River mouth sediment characteristics and sedimentation processes are also being studied by the geology and marine science departments; these scientific studies should be extended to include changes caused by river flow and discharge water volumes resulting upstream management of water flows.

**Key points of the discussions**
- Potential for joint EIA by universities in Myanmar and China
- Alternative canalization management of dams in river resource utilization
- Coordination and cooperation on research in water chemistry, sedimentation processes and physiochemical data of the Thanlwin estuary
- Possible joint academic publications
- Basic standard data and data collection methods for local inhabitants
- Combination of systematic community data and academic data from the universities
- Improvement of the role of community researchers and academics
- Joint project support for their activities
- Raising awareness and knowledge by the EIA process and outcomes
- Research focus on changes in natural resources
- Elaboration of the experiences and findings of river-basin communities
- Cooperation between scientific researchers and the government
- Need to get the attention of all stakeholders including government officials, businesspeople and grassroots people
- Visualization of SEA & EIA findings and scenarios will enhance sustainable development and the social life of the people
- Public education and knowledge promotion on river ecosystem-resource changes
- Letter to EGAT requesting the Salween River EIA Report conducted by Thai academics from Chulalongkorn University
- Establishment of a Thanlwin River Research Centre, Taunggyi University
- Possible joint research at Sat Se Marine Science Station
- Dissemination of (translated) workshop reports to relevant individuals and organizations
Opening Remarks

By HE U Thein Lwin
Secretary of the Natural Resources Conservation and Management Committee of the Parliament of the Union of Myanmar

Mingalarbar, distinguished guests, participants, ladies and gentlemen, I am really delighted and honoured to deliver the opening remarks on this auspicious occasion and to welcome all of you.

As you all are aware very well, Myanmar is endeavouring her best to attain a newly constructed democratic society since two and half years ago.

The transformation from a centralized system to a new democratic system is really significant and smooth compared to some middle-east countries.

However there are many challenges still waiting on our way to a new society. In achieving the development of any country there are always 3 Es we have to face. They are: Economic development, Energy supply security and Environmental impact. These three Es are very much interrelated, interlinked, interlocked and dependent on each other.

When we are talking about energy supply and environmental impact for Myanmar, the huge hydropower potential is becoming more and more significant. Even though Myanmar is rich in natural resources, we are still suffering energy poverty.

Especially on the Thanlwin River we have already identified large hydropower projects. Ta Sang (lower and high dams) with a first and second phase will have 7,310 MW installed capacity and the famous Hat Gyi project with 1,200 MW. Unfortunately the combined installed capacity of 8,510 MW was intended for export to neighbouring countries by the previous regime.

As far as my memory goes, we do not have sufficient environmental assessment studies for these mega projects. At the same time, with the momentum of development in our country, domestic energy requirements are becoming more and more significant.

I am just giving this as one example out of many other energy related projects in our country.

Therefore we do need to review whether all the ongoing and upcoming energy projects fulfil domestic requirements first and whether there is any systematic environmental impact assessment or not.

As a member of parliament, especially as Secretary to the Natural Resources and Environmental Conservation Committee, and with my personal background of 40 years’ experience in the energy sector, I have already submitted a proposal through the Hluttaw assembly to the government urging them to regard this kind of review as essential.

Today and tomorrow in this conference we are going to exchange information, share experience, discuss among us and look forward to the most efficient utilization of the still virgin Thanlwin River. This kind of conference is really important for us. We do need to learn from the experience of other countries. In other words, this is a kind of advantage for countries like us. Late comers can learn from others’ previous experience.

We do need to explore, examine, analyze, discuss and identify the potential development impacts and transboundary implications for future exploitation together with preventive resolutions for our beloved Thanlwin River.

In conclusion I would like to extend my sincere appreciation and gratitude to the co-organizers: Renewable Energy Association Myanmar (REAM) and Towards Ecological Recovery and Regional Alliances (TERRA) of Thailand, professionals from home and abroad for their esteemed participation and all participants.

I look forward the excellent outcomes from this conference.

Thank you very much for your kind attention.
Opening Remarks

By Mr. Veerawat Dheeraprasart

Chair, National Network of Natural Resources and Environmental Organisations, Thailand

Respected and dear participants, ladies and gentlemen, it is my great honour to open and address the Salween River regional conference today.

11 years ago I had the opportunity to travel to this country and I was able to reach the Salween River. It was the first time in my life that I felt I really touched by this river of mystery.

This river was known to some, but only by its name, and only that it is an international river. But how many have learnt profoundly the various dimensions of the values of the Salween River?

In comparison, the Mekong River, another international river in our region, is known to many more than the Salween.

For this reason, and based on my personal feelings, the Salween is mysterious and difficult to comprehend. I think behind it must be untold stories of history, archaeology, geology, ecology and biology that are special characteristics of the Salween River.

From the first time I came to this river, I could feel its greatness. This became the drive of my desire to study the values of the river in different respects, especially its ecosystems which include forests and wildlife which is my field of expertise.

Within Thailand, I have been collaborating with local community groups that live along this river, researching the river’s values under the Salween Study project.

For this reason, I have had to travel to and from the Salween River area in Thailand for 5 years. Every time I was impressed with what I saw and learned. And this, to me, was an invaluable experience.

While collecting information for the Salween study, I could see some of its weaknesses particularly a study on a small stretch of the river compared to the massive entirety of the Salween.

We were short of information in relation to the river mouth which is a vital part of the river system. This created a will in me that I had to see the mouth of the Salween in Mawlamyine one day.

Then I had the opportunity seeing its mouth at last in 2005. Though I spent only 3 days there, I could see the fertility of natural resources, both fisheries and agriculture. I could behold the culture and way of living of the people down there. I boated up river until I arrived in Pa-an seeing the lives of the people along the banks of the Salween.

From my visit to the Salween mouth that time, a thought came to me – one day academics from Mawlamyine University or someone else in Myanmar would undertake studies into the values of the Salween River mouth, and there would be academic exchanges and studies of its values would have been even more complete.

And if there were linkages among studies/research right from its watershed downstream, our knowledge/information on the values of the Salween would have by then been perfected.

What I wished to see and happen was cooperation among academics of different disciplines from respective countries which the Salween flows past, sharing with each other the information including results/findings of their studies, weaving all this academic information together so as to cover much broader areas and scope of issues, pinpointing the highest values of the river that deserve protection.

This day, right here, my wish has come true, although this workshop might be only the beginning.

I hope that you all will present your studies/research in relation to this invaluable river, exchange information, brainstorm ideas, discuss possible academic cooperation and bring forward accurate academic information as a basis for planning socio-economic and natural resource management in the Salween basin with a view to justice, peace and sustainability for the people of the Salween both at present and in the future.

I now declare open the Salween River conference.

Thank you.
Ecology, livelihood and concerns of seismic risk in the areas of the Nu/Salween River in China

Dr. Yu Xiaogang
Director of Green Watershed, Yunnan Province, China

Nu River Watershed and Peoples

The Nu River originates in Tibet, flows into China’s Yunnan province, then Myanmar and forms the Thai-Myanmar border before entering the sea at Mawlamyine, Myanmar.

The length of the Nu River in China is about 2,018 kilometers. The volume of the flow is 70 billion cu m, which is much more than that of China’s Yellow River which is only 55 billion cu m.

In July 2003, UNESCO listed the ‘Three Parallel Rivers’ area as a World Natural Heritage site comprising sections of the upper reaches of three great rivers in Asia, namely the Yangtze (Jinsha), the Mekong (Lancang) and the Salween (Nu) Rivers.

Considered a museum of nature, the ‘Three Parallel Rivers’ represent a significant bio-ecosphere rich in biological, landscape and cultural diversity. Reputed to be “the world’s biological gene bank”, forest covers as much as 72.9% of the area. Although this is no more than 0.4 percent of Chinese territory, the area is home to over 6,000 species of plant, and 488 species of wild life constituting 50% of China’s and 25% of the world’s animal species. Many endangered animal species can be found here, such as the snow leopard.

The Nu/Salween River flows from snowy mountains and cuts deep canyons through the Hengduan mountain range, an area also called the ‘Grand Canyon of the East’.

The Nu valley is a large area for rice growing and a variety of wild rice species that remain in China still grow there. It is a very special place in terms of biodiversity, and it is also called the area for genetic resources for China. It is especially important these days as we face climate change and food security crises.

For several decades, over 100,000 mu (15 mu = 1 hectare) of high quality land in the Nu River area has been continuously used for rice. Although each year China encounters many natural disasters damaging rice yields, local people in the Nu valley continue each year to harvest their rice without problem.

22 ethnic groups inhabit the Nu valley. Among them are the Lisu, Nu, Dulong, Pumi, Bai, Dai and Jinpo, constituting 92% of the total population. 70% of Lisu and Tibetan people are Christian.

Farmers generate income from agriculture, tree plantations, animal husbandry, herbal medicines, and tourism. There are 1.8 million tourists annually bringing an annual income of about 1 billion yuan.
The average annual income of rural people is 2,362 yuan (US$380) and of urban residents 12,116 yuan (US$2,000).

The Nujiang government has a forest protection policy banning resource use in the top zone of the mountains. The government has resettled people from mountainous zones down to the valley zones, urbanizing the valley zone. This policy is to protect the value of the Nu River.

The Nu people live happily. Of course people do not agree with the government protection policy because for generations, they have lived in the mountains where they hunt and collect vegetables, plants and herbs for their daily lives.

Seismic risk and dam building in the Nujiang valley

My presentation is based on recent research on seismic risk in relation to dam building in the Nujiang valley. Any dam builders should pay serious attention to this issue.

In 2003, a cascade of 13 dams was proposed for the Nu (Salween) River. These dams have combined capacity of 21,320 megawatts.

These projects are considered highly profitable, as the (state-owned) hydropower company could earn up to 34 billion yuan annually, while government could gain 8 billion yuan in tax: the central government, Yunnan government and Nujiang prefecture government would get 5.3 billion yuan, 1.7 billion yuan, and 1 billion yuan respectively. They are all very interested in these projects.

Similarly, hydropower projects on the lower reaches of the Salween River are also considered as profitable projects for Thailand and Myanmar.

There are also many more dams planned in Tibet on the upper reaches of the Nu River. Recent data shows altogether 27 dams. Therefore, with all of these dams planned, we have to pay serious attention to the seismic risk.

Seismic and geologic study of the Nujiang valley

In January 2011, two senior scientists from the Chinese Academy of Sciences, Mr. Xu Daoyi, a seismic scientist, and Mr. Sun Wenpeng, a geologist, and Green Watershed conducted a field survey in the Nujiang valley. At that time we went to investigate all 13 dam sites, and also investigated big landslides.

Notably, the geography of the Nujiang valley area is, as we know, the collision of the Indian Plate and the Eurasian Plate, which created what we call the Qingzang High Plateau and the Hengduan mountain ranges.

This crash caused the fault lines, one moving south to north to the Tibetan Plateau, and at the same time another fault line moving north to south, from China to Southeast Asia. So you can see that the Nu River fault is the major geological feature of this stretch of the river, like other rivers such as the Mekong.
The geological fault line is the Nujiang fault line. And Nujiang itself is a large deep fault line of about 600 kilometres. Earthquakes normally occur around this fault line in or near Nujiang.

Five years ago, there was a large earthquake in southwest China in Wenchuan. Many earthquakes of a magnitude larger than 7 occurred in western Yunnan near the Nujiang watershed, especially in Tibet, twice in Longling, Yunnan, on the China-Myanmar border, and in Lijiang, Yunnan. The large Wenchuan earthquake in Sichuan in 2008 was also not far from the Nujiang watershed.

### Large earthquakes in the last 60 years in Southwestern China (Ms ≥ 7)

<table>
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<tr>
<th>Year</th>
<th>Month</th>
<th>Day</th>
<th>N. Latitude</th>
<th>E. Longitude</th>
<th>Ms</th>
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<td>8</td>
<td>15</td>
<td>28.5°</td>
<td>96.0°</td>
<td>8.6</td>
<td>Chayu, Tibet</td>
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<td>11</td>
<td>18</td>
<td>31.2°</td>
<td>91.4°</td>
<td>8.0</td>
<td>Dangxiong, Tibet</td>
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<td>1</td>
<td>4</td>
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<td>7.8</td>
<td>Tonghai, Yunnan</td>
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<td>1973</td>
<td>2</td>
<td>6</td>
<td>31*29'</td>
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<td>5</td>
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<td>98*52'</td>
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<td>11</td>
<td>6</td>
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<td>7.6, 7.2</td>
<td>Lancang Gengma, Yunnan</td>
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<td>11</td>
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<td>China-Myanmar border</td>
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<td>3</td>
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<td>96.59°</td>
<td>7.4</td>
<td>Yushu, Qinghai</td>
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**Transboundary River Development: Impacts and Risks**

*By Witoon Permponsacharoen, MEE Net*

The Salween River is an international river, passing through three countries. Country borders do not perfectly overlap ecological boundaries. If one country does anything to the river, it can affect the whole river basin.

The concept of the international river indicates that shared river basins should be developed through cooperation among the countries within the basin because they share a common resource. On one hand, countries can work together on development issues. On the other hand, they must have mechanisms for cooperation in order to protect the environment or mitigate harmful impacts.

In contrast, the concept of sovereignty argues that countries can do whatsoever they want, even if this has an impact on neighbouring countries. This happens in many places in the world. As of now, the concept of international rivers and cooperation that has been developed and practiced in many parts of the world is still not fully in place in the Mekong Region.

For example, in case of the Mekong River, a study by Mekong River Commission (MRC) stated that dam construction on the mainstream Mekong River would cause the disappearance of 2-3 million tons of fishery product, worth US$2.5 million annually. These fisheries are the main source of protein for 60 million people in the Mekong basin. The big question is how one can expect to effectively replace the protein intake for these communities.

The MRC was established in 1995 to enhance cooperation among the lower Mekong countries. But as we can now see, the case of Xayabouri Dam, a 1,200MW project built in Lao territory, created concerns because the MRC countries disagreed on some points. Despite this, Lao government finally decided to go ahead with the project.

China shares many international rivers with other countries. In the case of the Mekong River, which originates in China and passes through five countries downstream, China has built several dams on the upper reaches and never formally joined the Mekong River Commission. However, in 1995 – the same year that the MRC was established – China signed an agreement to form the Tumen River Area Development Programme (TRADP) with Russia and North Korea, with the objectives of regional cooperation, economic development and environmental management.

So the question to be raised with China is this: is this a double standard? Why has China accepted cooperation on the Tumen River, but not on the Mekong and Salween rivers?

27 dams have so far been proposed for the Salween River, and there are still no mechanisms for cooperation among the countries that share the river. So before any construction begins, should the developers not wait and discuss, with the cooperation of the three countries, what kind of common framework is needed to protect the river? This process needs the strong participation of civil society; otherwise developers may just unilaterally agree and go ahead with their plans.
Increase in Yunnan earthquakes in last 500 years (1450-1999)

We can also say that in the last 500 years the number of earthquakes in Yunnan is increasing. As indicated in the graph, between 1500 and 1900 there were few earthquakes, but since the year of 2000 we can see many, indicating a significant increase in the last 500 years.

Regarding climate change, due to the seismic conditions, geology and topography, extreme rainfall in the Nujiang area resulting from climate change triggers landslides every year.

The China geological disaster map shows that the Nujiang area is marked as at the highest risk of geological disaster, with 657 potential landslide spots in the Nujiang valley.

To sum up, Southwest China has entered a period of more severe and more frequent earthquakes. Therefore, in the Nujiang area, any hydropower development decision must pay serious attention to the risk of seismic and geologic disasters. In the case of the large Wenchuan earthquake in Sichuan in 2008, people were well aware of the number of casualties, but nobody knew much about over 200 small and medium dams that cracked. Also, the Lushan earthquake in April 2013 cracked or damaged over 500 dams.

After the survey trip in January 2011, a survey report was sent in February 2011 to Premier Wen Jiabao, who requested the Yunnan government and Ministry of Water Resources to do more research on seismic risk. The Yunnan government agreed to investigate the seismic risk of dam building on the Nu River before starting dam construction.

Transboundary Environmental Impact Assessment in Utilizing International Waters in a Chinese Context

By Dr. Bian Yong Min, University of International Business and Economics, Beijing

Chinese law only requires an environmental impact assessment (EIA) of the effect of projects on the environment within China's territory. China nevertheless has an obligation to assess the environmental impact that domestic projects cause outside its borders.

In addition, China is under an obligation to conduct a transboundary environmental impact assessment (TEIA) when there is a risk of environmental harm outside its national jurisdiction, particularly regarding a shared resource. As a consequence, current and future negotiations between China and its neighbours on transboundary resource management should include TEIA in order to foster cooperation, prevent disputes, and allow public participation.

A TEIA has been included in some of China's international commitments to its neighbour states. The best example is the Memorandum of Understanding (MOU) on Environmental Principles Governing the Tumen River Economic Development Area and Northeast Asia signed on 6 December 1995. China also signed an agreement with Mongolia on the Conservation and Utilization of Border Water on 29 April 1994. On China’s north-west border, the Agreement between the Government of the People’s Republic of China and the Government of the Republic of Kazakhstan on the Cooperation on Using and Protecting the Trans-Boundary Rivers was signed on 2001. A Memorandum Between the People’s Republic of China and the Russian Federation on Joint Monitoring over the Quality of Water of Transboundary Rivers was signed in 2006.

In 2002 to address the lower Mekong states’ concern about China’s utilization of the upstream Mekong, the Lan-Cang River, the Agreement on Provision of Hydrological Information of the LanCang/Mekong River in Flood Season by the People’s Republic of China to the Mekong River Commission Secretariat was signed. This agreement was updated in 2008. Similarly, the Memorandum on Provision of Hydrological Information of the Yarlung Tsangpo/Brahmaputra River in Flood Season by China to India was signed in 2002 to address India’s concern about the Yarlung Tsangpo, known downstream as the Brahmaputra.
Ecology and livelihood:
Case studies from particular ethnic states of Myanmar

Mr. Montree Chantawong
Towards Ecological Recovery and Regional Alliance (TERRA)

The Thanlwin/Salween is a 2,800 kilometre long river, with one third of its length in Myanmar. This grand river originates in China, entering Myanmar in Shan State, passing through Karenni and Karen States and emptying into the Andaman Sea at Mawlamyine city in Mon State. When it passes Karen State, the Thanlwin/Salween River becomes the border between Thailand and Myanmar for around 127 kilometers, with many significant tributaries on both the Thai and Myanmar sides:
- Pang, Teng and Sim rivers in Shan State;
- Pai and Moei rivers in Thailand; and
- Ataran and Gyaing rivers in Mon State (at the river mouth)

Many people might say that the Thanlwin/Salween is still a mysterious river due to the very limited research on it, especially regarding its ecosystem and the livelihoods of people living in the Thanlwin/Salween basin, and the fact that it is almost never visited by outsiders. The conflict over the past several decades between the Myanmar government and numerous ethnic groups caused a major threat and almost completely cut off all areas along the Thanlwin/Salween River from the outside world. People could access only the lowest part of the river, from Pa-an city to Mawlamyine city.

Despite many limitations, Thanlwin/Salween basin ecosystem studies conducted by many organizations along the Thailand-Myanmar border pointed out diverse potential effects on ecosystems and local livelihoods caused by hydropower projects on the Thanlwin/Salween River: the Hat Gyi, Dagwin, Weigyi, Ywathit and Ta Sang Dams as well as on vital tributaries, such as the Lawpita Dam.

The many interesting studies include:
• ‘In the balance: Salween dams threaten downstream communities in Burma’ by the Mon Youth Progressive Organization (May 2007);
• ‘Khoe Kay: Biodiversity in Peril’ by the Karen Environmental and Social Action Network (July 2008);
• ‘Dammed by Burma’s Generals: The Karenni Experience with Hydropower Development From Lowpita to the Salween’ by the Karenni Development Research Group (March 2006); and
• ‘Roots and Resilience’ by the Shan SAPAWA Environment Organization (August 2009).

Overall, these studies present the complexity of the ecosystems of the Thanlwin/Salween River and its tributaries in three areas:
(1) The Thanlwin/Salween river mouth ecosystem
(2) The forest and river ecosystems in the Khoe Kay community close to the Thanlwin/Salween River in Karen State
(3) The Keng Kham community ecosystem close to the Pang River (tributary of the Thanlwin/Salween) in Shan State

• In the balance: Salween dams threaten downstream communities in Burma by the Mon Youth Progressive Organization (May 2007)

This study shows the abundance of the Thanlwin/Salween River ecosystem, the relationship between the tides and the adaptation of agricultural communities near the river mouth where two enormous rivers: the Ataran (originating in Thailand) and the Gyaing, meet. These three rivers are wide and deep enough for large boats in the dry season.
The study discloses how the Thanlwin/Salween dams may impact the complex and delicate ecosystem of the river delta and the livelihoods of half a million people living in that area. Moreover, it shows the key issue in the main tributaries of the Thanlwin/Salween, the Ataran and Gyaing Rivers; this is salinization due to tidal exchanges between sea water and fresh water at the river mouth. It also identifies three different features of water salinity, seasonal changes and the types of fishery in three different areas of the Thanlwin/Salween River:

- **Section 1**: Where the Thanlwin/Salween River flows into the Andaman Sea, the water has quite a high salinity level. Therefore, people can make use of the river only in the rainy season and it is necessary to store fresh water for the dry season. Agricultural areas also need to be adjusted by making “canals”, especially in the rainy season.

- **Section 2**: In the northern part of Thanlwin/Salween River there is more fresh water which can be used all year long.

- **Section 3**: The section of the river which contains 100% fresh water but is still affected by currents.

During the dry season, from April to May, the Thanlwin/Salween River has the lowest water level and the influence of tides affects around 25 km of the Thanlwin/Salween River from the river mouth, around 75 km of the Ataran River and around 60 km of the Gyaing River.

In 5 townships, there are approximately 100 villages in the area connected to these 3 rivers, 10 of which are on 31 islands with approximately 500,000 people depending on the Thanlwin/Salween River mouth ecosystem.

Fish migration (between the Thanlwin/Salween, Ataran and Gyaing rivers) is one of several examples of the relationship between salt water and fresh water which helps fishermen catch various types of migratory fish, such as kaplon pain, hilsa or nyathaloke, Spanish mackerel or kahadi, mango-fish, bummalo, snakehead, catfish, feather back, nyathaloud, kapaloi pain, nyagin, and kamanyot. Many are very much in demand among the Mon people and can be sold at high prices.

However, the abundant Thanlwin/Salween River mouth ecosystem is, from a holistic point of view, quite sensitive to the tides and the river flow in both the rainy and dry seasons.

**Khoe Kay: Biodiversity in Peril** by the Karen Environmental and Social Action Network – KESAN (July 2008)

Khoe Kay is a community located around 250 km upstream from the Thanlwin/Salween River mouth on the Thailand-Myanmar border. The study area covers approximately 90 km², most of which is deciduous forest and evergreen forest bordering the Thanlwin/Salween River and its tributaries. Various issues in the study, such as types of forest, plant, fish, bird and wild animal, were done by a KESAN team in collaboration with local people.

This study revealed that the ecosystem in this area is especially rich as proved by the following discoveries:

- 194 types of plant.
- 200 types of animal, 42 of them endangered species on the IUCN Red List.
- Forest diversity: 400 m from the bank of the Thanlwin/Salween, there is mixed deciduous forest, many bamboo forests 400-700 m from the shoreline, mixed deciduous forest again 700-900 m from the bank and mostly montane evergreen forest 900-1000 m from the bank.
- According to a study of fish in the Thanlwin/Salween River and its tributaries, 170 fish species were found, 60 of which are endemic.
- Animals living in the wild and sometimes found near villages include tiger, wild elephant, gaur, clouded leopard, Asiatic black bear and slow loris.
Villagers can benefit from the variety of plants:
- About 35 types of herbal medicines;
- Many kinds of food resources, such as ginger, woody vines and edible ferns;
- Materials for house-building.

Also, villagers can catch fish in the Thanlwin/Salween and its tributaries for household consumption.

The fertile ecosystems of Khoe Kay village include its forest area where not only teak is found (the village was in the past well-known as a logging area), but which has retained a richly diverse ecosystem until today.

- **Roots and Resilience** by the Shan SAPAWA Environment Organization (August 2009)

  This report focuses on the ecologically unique area of Keng Kham community close to the Pang River (56 km upstream from its confluence with the Thanlwin/Salween) in Shan State. It shows that 15,000 people were forcibly relocated over ten years ago and there are now 996 families left in 114 villages (of more than 3,000 families in the past); the majority have fled to Thailand.

  Today, the estimated 3,000 that remain are managing to maintain their livelihoods and culture despite constant threats from the Burmese Army and the impending TaSang Dam. The impact of forced relocation has been devastating to the Keng Kham community as thousands of acres of formerly fertile farmland lay fallow and villages lie deserted. Furthermore, excessive logging also occurs in areas around the dam site. Logs from the area, including teak, are exported to China and Thailand.

  The report states that the TaSang dam will be the ‘death knell’ for the Keng Kham community as the dam will submerge the community, its ecology and its culture.

- **Dammed by Burma’s Generals: The Karenni Experience with Hydropower Development From Lawpita to the Salween** by the Karenni Development Research Group (March 2006)

  This report looks at the impacts on the Karenni people since Burma’s first large-scale hydropower project at Lawpita Falls in Karenni State. Contrary to project claims, what the Karenni actually gained were water shortages and destructive floods that destroyed their crops, as well as a reservoir that displaced 12,500 people and disrupted fish habitats.

  The report also examines the potential impacts of the planned Weigyi Dam on the Thanlwin/Salween River, including a Singapore-size reservoir that will submerge the ancient capital of Bawlakhe, fertile farm lands and some of the world’s last remaining rainforests, leading to irreversible environmental damage. In addition, the dam would directly affect an estimated 30,000 people, including the entire Yin Talai – a ethnic sub-group of Kayah whose current population is only 1,000 people.

  These studies are some of a few that relate to the Thanlwin/Salween River ecosystems and the livelihoods of people living in such areas. The full versions of these reports can be downloaded from the Salween Watch website: [www.salweenwatch.org](http://www.salweenwatch.org).
The Salween River originates in the Tibetan highlands, part of the Himalayan mountain range, flows through China’s Yunnan province into the Shan, Karenni and Karen states of Myanmar, and forms the border between Thailand and Burma before re-entering Myanmar and emptying into the Andaman Sea at Mawlamyine. With a total length of 2,820 kilometers, the Salween River is the world’s 26th longest and the only remaining major free-flowing river in Southeast Asia.

Bordering Thailand and Myanmar for 127 kilometers, the Salween River passes by Mae Sariang and Sop Moei districts of Mae Hong Son province in northern Thailand. On the Thai side, several important tributaries such as the Pai, Ngao, Yuam, Moei, Suriya and Mae Kasatri rivers, running through Tak, Chiang Mai and Kanchanaburi provinces as well as Mae Hong Son Province; flow into the Salween River.

In 2003, the Electricity Generating Authority of Thailand (EGAT) assessed the hydropower potential of the lower Salween River. Four major dams were planned. Two projects are in Myanmar, the Ta Sang dam in Shan State and Hat Gyi dam in Karen State, and two on the Thai-Myanmar border, the Upper Salween dam (Weigyi) and Lower Salween dam (Dagwin). These projects have combined capacity of 12,400-16,000 megawatts (MW).

According to EGAT, the most feasible for investment were 2 Thailand-Myanmar bilateral projects i.e. the Upper Salween (Weigyi) dam (4,540MW) and the Lower Salween (Dagwin) dam (regulating dam). The power station of the Weigyi dam was to be located on the Thai side (in the Salween Wildlife Sanctuary), while that of Dagwin in Thailand’s Salween National Park. The Upper Salween dam would create a reservoir 380 km. long which would flood 960 sq. km. EGAT highlighted the “cheap” cost of electricity, as EGAT’s governor at the time stated that “Myanmar doesn’t have any demand for electricity, so Myanmar will sell the entire electricity output to Thailand, and it will be very cheap”. A particular reason for EGAT being active in pushing for the Salween dams was because it looked to connect these projects to the ASEAN Power Grid Project.

Further rationalising the projects, EGAT claimed that one of the outstanding features for investment in the Upper Salween dam project is the “very small” affected area in Thailand – only three per cent of the reservoir’s total area would be flooded. Also, this area is uninhabited as it is on a high and steep mountain range where humans and even wild animals cannot live.

However, EGAT’s claims were contradicted by certain public figures such as senators and members of the National Human Rights Commission and the National Economic and Social Advisory Council. For instance, based on the findings from his field visit (together with a group of senators) to Tha Ta Fang village, Mae Sariang District in April 2003, Kraisak Choonhavan, Chair of the Senate Committee on Foreign Affairs, noted that “the data presented by EGAT about the inundated area has never been consistent. In the dam construction site where we visited”, he added “at least three villages have been settled there for almost a hundred years.”
Politics of Knowledge & Competing Values:

While EGAT was (and continues to be) inclined to valuing the Salween River as a cheap energy source, others had completely different ideas. In particular, the people of the three villages in Mae Hong Son Province who were to be affected if the Salween dams proceeded, value the Salween as an invaluable source of their livelihoods. Given these conflicting values at the time, Towards Ecological Recovery and Regional Alliance (TERRA)/the Foundation for Ecological Recovery (FER) discussed with them and other local groups based in Mae Hong Son Province about the dams proposed by EGAT. Consequently, we agreed to work together to research and document the value of the Salween from the local people’s point of view, and publicize this among the general public.

That is how the ‘Salween Study’ project came about as a joint initiative by representatives of the three villages along the Salween in Mae Hong Son province (Tha Ta Fang village, Mae Sariang District, and Mae Sam Lap and Sop Moei villages in Sop Moei District); the Mae Yuam Civic Group in Mae Sariang district; and Towards Ecological Recovery and Regional Alliance (TERRA)/the Foundation for Ecological Recovery (FER).

It was agreed that the main research objective was to compile information on the socio-cultural and economic significance of the Salween River, particularly the various benefits that communities derived from its natural resources, and to fill the knowledge gap on the value of the Salween River which was virtually unknown to the general public.

A participatory approach was adopted in the research, with community members carrying out the research and compiling data/information on jointly identified issues such as the history of the community, local ecological knowledge and means of livelihood as related to the Salween. Community members knowledgeable about local history, river and forest ecosystems and fisheries were chosen by the villagers to be the local research coordinators. The coordinators were responsible for compiling and synthesising the information, as well as supervising and coordinating the study team in addressing each thematic area.

The expected outcomes are: 1) baseline data/information on the value of the Salween River; 2) strengthening of communities along the Salween River; 2) recognition of the knowledge and rights of the local people; and 3) increased public awareness of the values of the Salween River.

At least five steps were taken: 1) selection of topics and research coordinators for each topic; 2) a series of workshops in three communities; 3) data collection; 4) research report; and 5) presentation of the results to the communities and public.

Salween Study: Community-based research

Presented by Mr. Pairote Panapraisakun

The Salween River that I am going to talk about now is from my own perspective. It is based on what I have seen, experienced and learned for most of my life but along this particular 180 kilometers stretch of the Salween which forms part of the border between Thailand and Myanmar. I know this river very well. I know its ecosystems and the lives of its people of whom I am a member, not only on the Thai side but also on the Myanmar side. I observed, and associated with the people with whom I grew up. As a learned person of the village, I had the knowledge. A research project with which I was more recently engaged helped substantiate what I knew.

Part of the water is snowmelt from the Himalayas where the river begins, that’s why the water of the Salween is naturally cold. Tributaries of the Salween; big ones like the Pai, Mae Sarok, Yuam, Ngao, Moei and numerous small ones numbering 57; add water to the Salween. It is really a turbulent river with many rapids, whirlpools, rock outcrops, and stone and sand beaches.
I can provide quite exact figures for these different natural ecosystems. For instance, this 127 km section alone, that borders Thailand and Myanmar, has 21 rapids, 35 deep pools, 20 rock outcrops where fish feed and spawn, and 30 sand beaches where people cultivate crops after the water recedes. Here I will provide more details for each of what I call ‘sub-ecosystems’:

**Rapids**: These help cleanse the water, adding oxygen to the river, and provide habitats for large-size fish. Rapids draw natural feed and function as a refuge for fish that need to hide from hunting by humans and other animals. Most rapids emerge or disappear according to the rise and fall of the water level of the Salween. Some rapids have a large structure and are thus visible all year round. Mae Ko, Mae Kho and Weigyi are local names for rapids of the latter type. They all help keep the balance of the river ecosystems.

**Deep pools**: The water is still, with many holes and cavities providing safe habitats for fish. Some deep pools take sand sediments appropriate to particular scaled fish e.g. *Pla Kao*, *Pla Tong*, etc.

**Rock outcrops and stone beaches**: When water levels are low, this type of sub-ecosystem is visible and has a particular function. For instance, it is the spawning ground for fish especially in December-April. This sub-ecosystem is therefore an important element in the fish cycle without which aquatic diversity and populations could not be maintained. On the beach are small and medium size stones. When the water recedes, part of the beach becomes part of the land. In the other part that remains underwater the current is strong, and hence becomes a habitat for particular small-size fish that feed and spawn here.

**Sand beaches**: This sub-ecosystem is seasonal as it is visible only when the water recedes. Crops are cultivated here from October onwards. The sand beach itself and its use is an indication of the relationship between the people and the river. People grow different crops according to what they need and what is relevant to the area. People also derive income from the beach through selling products in the market.

The beach is naturally fertile. When water rises and beach disappears, nutrients that come with the sediments are deposited. When water declines, the beach re-emerges and becomes fertile agricultural land perfect for growing crops. Produce from the beach is organic and low cost because no chemical pesticides or fertilizers are needed to grow them.

Two types of beach are noticeable along the Salween: beaches that emerge in the dry season with nutrients mixed with sand particles, and beaches mixed with soil. Each type is suitable for particular crops. The timing of the fall in the water level allows diversification of crops of varying life cycles and water consumption needs. Cultivation on the beach earns each household from 5,000 to 30,000 baht. So the beach is a significant factor contributing to the household and village economy and we must bear in mind that consuming chemical-free products is good for our health.

Each year, the water begins to rise in May and falls in October. From July to September, it is noticeable that the water rises for one day, stays constant, then declines, or rises for 1-2 days, stays constant and may keep rising for another 1-3 days and again stays constant. The water may continue to rise for another 1-2 days. When water rises it will not stay constant at a particular height for longer than 7 days before falling. This allows plants such as vegetables to survive as long as the flooding does not last longer than 3-7 days. On the contrary, this kind of flooding even fertilizes the farmlands.

Predicting river flow each year depends on the weather forecasts. The people of the Salween however, have different way. They observe where the tortoise lays eggs. Normally during March-April, tortoises come aground to lay eggs. The very point where they lay their eggs is the highest point which the water level will reach.
With the functioning of different sub-ecosystems and their contributions to the fish life-cycles, fishery resources remain abundant. The people know the seasonal changes, the natural rise and fall of the water. They also know the fish, both native and migrants. The research effort undertaken years ago of which I was a part found at least 83 different types of fish in the Salween and its tributaries. The people know where different fish live and how to catch them. The livelihood from fishing is sustainable. People catch fish to make a living and derive income from it, each household earning from 10,000 up to 50,000 baht.

The fishing involves making fishing gear, using local materials and the wisdom of the people along the Salween. The people of the Salween today have different gear appropriate for the season or river level as well as the habits of different fish. Different gear is created and developed from wisdom in which ecological awareness is a key element. Thus catching fish with this gear never disrupts nature or the fish life cycle. The river ecosystems are balanced and hence fishery resources are sustained.

One particular type of the forests through which the Salween flows has teak as one of its main species and these forests are fertile. This is noticeable through observing the ‘greenness’ of the forests as well as the diversity and population of the wild animals found in the forests of different types, creating and sustaining the interrelations of plants and the animals.

Surrounding the forests are the settlements of the local people. Near the Salween and its tributaries surrounded by fertile forests are some 50 villages, 43 on the Thai side and 7 on the Myanmar side. The people on both sides must live near the forest for they depend on it for food and housing. The people and the forest co-exist in harmony. The fertility of these forests also ensures that the 57 tributaries of the Salween remain in good health and will keep replenishing the Salween, indicating critical relations between the river and forest.

We have quite a diversity of forests along the Salween. This is noticeable through the different characteristics of the forest – we have forests where trees lose their leaves, forests that stay evergreen, teak forests and so forth. We also have forests used for growing various crops for a year or so, then left to lie fallow for several years for the forest to regenerate. The forest is a source of our lives. Every year, we collect foods such as vegetables, mushrooms, and bamboo shoots. Het tob, a type of mushroom, alone can earn 10,000-50,000 baht for each household. So, the forest is so important to our lives. We know this so we know that we need to preserve it, and when we use it, we need to do so in a sustainable way.

The people of the Salween have lived in harmony with the river and the forest since time immemorial. They have adapted to nature, creating a particular way of life in the river basin. They have also lived in harmony with one another, not only among those on each side but between the people on both sides. Today, we the Salween people of the two countries still maintain a respectful relationship. We share the same beliefs, traditions and cultural values. We share similar ways of life: we catch fish and grow rice and upland crops, where we preserve seeds so as to forever sustain our own genetic resources. We build our own society, linking all communities along both sides of the Salween.

During the Salween Study, a series of workshops were held in each of the three villages to share preliminary results and facilitate input from other members of the community.

The Salween Study also received support and contributions from a range of academics in different fields of expertise: archaeology, ornithology, geology, forestry and fisheries. Some of them visited the Salween River to conduct short field surveys and participated in exchange workshops with village researchers. Others contributed through sharing their knowledge obtained from previous research in the Salween basin.

The results of this study were presented at a provincial level conference in March 2006. The conference was attended by representatives from the communities, government officials, academics and nongovernmental organisations.
Potential impacts of damming the Thanlwin River in Myanmar

Prof. Dr. Maung Maung Aye
Rector-in-Charge (Retired), Y.U.D.E.; Patron and Chief Advisor, Myanmar Environment Institute (MEI); Member, IGU Commission on Hazard and Risk

1. A Large Free-flowing Rivers From Source To Sea
- 64 large free-flowing rivers in the world
- Asia (excluding Russia) has 4 large undammed rivers remaining that run from source to sea, most notably the Brahmaputra and Thanlwin rivers.
- Both have their source on the Tibetan plateau.
- The Thanlwin is under serious threat of fragmentation on the main stem, with plans for cascades of dams on both the Upper Thanlwin (Nujiang) in China and the lower reaches in Myanmar.

2. Basin Characteristics
- The Thanlwin River (Nujiang or Nu/Nam Kong or Kong/Salween or Salawin) should be selected as a case study based on the following criteria:
  - **Threat to river integrity**: This is based on an assessment of available information on planned dams on the Thanlwin;
  - **Biodiversity value**: an assessment of the variation in ecosystems linked by the river, as well as an assessment of the conservation value of ecosystems (uniqueness) and the presence of endangered or vulnerable species;
- **Length**: 2,820 km (1,749 miles)
- **Source**: T’ang Ku La (Tangula), Eastern Tibet
- **Mouth**: Gulf of Mottama (Gulf of Martaban), Katpali Sea (Andaman Sea)
- **Countries**: China, Myanmar, Thailand
- **Threat of modification**: Extremely high
Thanlwin has its source on the Tibetan plateau, flowing down through steep valleys in China’s Yunnan Province and through Shan, Kayah, Kayin and Mon states of Myanmar, before entering the Katpali Sea (Andaman Sea).

The Thanlwin basin covers around 270,000 km² and supports a unique Indo-Burmese fauna, although it shares similarities with the Ganges and Ayeyarwaddy (Irrawaddy) river faunas.

There are around 140 species of fish in the basin, of which 47 are endemic.

It also has the world’s greatest diversity of turtles, including riverine species.

The Thanlwin basin spreads over several important terrestrial ecosystems, including Northern Indochina Sub-tropical Forests in the middle basin and Alpine Conifer and Mixed Forests of the Nuijiang and Lancang (Mekong) Gorges.

The forests of the lower Thanlwin basin form an expanse of deciduous forests with large stands of teak.

The Thanlwin basin is home to numerous different ethnic communities, many of which rely on the river for their water supply and livelihoods.

In Myanmar the main ethnic groups are the Shan, Kayah (Karenni) and Kayin (Karen).

In China there are numerous smaller groups including the Lisu and one of China’s smallest ethnic groups, the Nu.

Fisheries are important along the length of the Thanlwin, but are especially highly valued in Myanmar and Thailand.

Hydropower development along the Thanlwin is not new, but until now has been confined to its tributaries.

Plans for large scale development of the main stem of the Thanlwin are now moving ahead in both China and Myanmar.

In China plans exist for a cascade of 13 dams in the upper Thanlwin, with a total capacity of 21,320 MW and involving the resettlement of up to 51,079 people.

Hydropower development on the Thanlwin stretch in Myanmar involves plans for 2 dams at Ta Sang and several dams in the lower reaches of the Thanlwin, relatively close to the estuary.

In November 2005, the Bangkok Post reported that the Hat Gyi Dam would be the first of a series of dams on the lower Thanlwin to be developed together with neighbouring Thailand.

The dams will provide economic benefits through the export of electricity to urbanized areas of Yunnan and Thailand where demand for electricity is high, whilst jobs will be created during the years needed to complete construction of the projects.

But at what cost to the environment and to local communities?

Construction of up to 20 large dams will have a devastating impact on the ecological balance of the Thanlwin.

China had proposed a 13-dam cascade on the middle and lower reaches of the upper Thanlwin with a combined capacity of 21,320 megawatts.

On April 1, 2004, the Chinese premier halted the construction of 13 dams on the Nu (Thanlwin) in Yunnan province.

The upper reaches of the Thanlwin are just being discovered as a site for white-water rafting and there is good potential for other forms of ecotourism in the region, including nature tours, cycling and trekking.

Whilst it is unlikely that these kinds of industries will bring in similar amounts of money as the dam, they could, combined with sensitive development of the potential of the Thanlwin’s tributaries, offer a sustainable alternative.

Fisheries are important in the large river deltas of Myanmar, but may experience negative impacts in the future if the Thanlwin is dammed.
3. Dam and Water Diversion Plans on the Thanlwin River and their Potential Impacts

- The Myanmar and Thai governments and EGAT are pushing ahead quickly and secretly with plans for a series of 5 giant dams on the Thanlwin and its tributaries.
- The following are potential dam sites and water diversion projects on the Thanlwin:

**Proposed Thanlwin Dams**

### 3.1 Kunlong Dam (Upper Thanlwin)

In April 2007, two Chinese companies, Farsighted Investment Group and Gold Water Resources, announced plans to finance and construct an “Upper Thanlwin” dam in northern Shan State, Myanmar, with a total installed capacity of 2,400 MW. Little is known about this plan as this was the first report of it.

**Impacts:**
- All of the dams planned on the Thanlwin will greatly disrupt the riverine ecosystem and destroy the livelihoods of those peoples living along the river.
- Large areas of land used by many ethnic peoples for traditional farming and medicines will be flooded.
- Those living along the river will be forcibly relocated, probably without compensation.
- Villagers living downstream from the dams will also face difficulties.
- Alterations in the Thanlwin River flows will disrupt downstream estuaries, which will harm the agricultural and fishing practices of villagers who depend on those estuaries.

### 3.2 Ta Sang Dam

This is the largest of the series of proposed hydroelectric power projects on the Thanlwin in south central Shan State, 40 km north of the Ta Sang River crossing, and about 130 km from the Thai-Myanmar border.

- The 7,110 MW, 228 m high dam is slated to be the tallest dam in all of Southeast Asia.
- The reservoir will flood hundreds of square kilometres.
- The initial estimated cost of constructing the Thanlwin was US$ 6 billion.
- Most of the electricity from the Ta Sang dam is intended for sale to Thailand.
- Already over 300,000 people have been forcibly relocated from the area since dam studies commenced in 1996.
- If built, the Ta Sang dam will drive thousands of people from their homes and will involve even more forced relocations by the Myanmar government.
- Increased militarisation has already led to an increase of reports on human rights abuses in the Ta Sang area.

**Impacts:**
- The Tasang dam is located in the midst of an active conflict zone in Shan State, and tens of thousands of ethnic peoples living near the dam site and floodplain have been forcibly relocated.
- In June 2007, the Myanmar Army confiscated land in Wan Mai village of Maitong Township and gave it to MDX company to build an office.
- The Tasang dam floodplain will extend nearly to the China border, literally dissecting Shan State; comprehensive research on the affected population has yet to be conducted.

### 3.3 Weigyi Dam

- The reservoir will flood hundreds of square kilometres.
- This is located on the Thai/Myanmar border close to where the Thanlwin flows out of Kayah State in Myanmar.
- According to the Japanese Electric Power Development Corporation study, the dam will have a projected capacity of 4540-5600 MW, and a flood height of 220 meters, flooding between 700 and 1,000 km² of forest, river and farmland, mostly in Kayah State.
- Dam construction is estimated to cost US$ 3 billion.
- Most of the electricity from the Weigyi dam is intended for sale to Thailand.
Although the project site is located in Papun District, Kayin State, Myanmar, just across from Mae Sariang District of Mae Hong Son Province in Thailand, it is Kayah State that will bear the major impacts of the Weigyi dam.

The Weigyi dam reservoir will flood much of the best lowland forest and agricultural land in Kayah State.

On the Thai side, the site is part of the Salween Wildlife Sanctuary and the access road that is being constructed passes through the Salween National Forest.

Impacts:

- An estimated 640 km² reservoir will be created by the Weigyi Dam in Kayah State.
- 28 towns and villages, including the ancient towns of Kayah, Bawlakhe and Hpsaung, will be submerged.
- Over 30,000 people, including the last remaining 1,000 Yin Talai people, will be displaced from their homeland.
- An influx of refugees into Thailand can be expected.
- Even if Weigyi is not built, the downstream impacts from the TaSang dam will include the disruption of natural water flows, a loss of fish biodiversity and decreased water quality.
- Livelihoods will be destroyed and eventually the Kayah people will face a major loss of culture, as most historical places will be submerged.
- The Yin Talai people, whose entire remaining population is just 1,000, will face extinction because of the dispersion and changes in livelihood caused by displacement.
- Furthermore, if the project is implemented as the Lawpita hydroelectric power project was, the local people who live around the dam site will face human rights abuses, forced relocation, land confiscation and landmine casualties.
- Like Lawpita, the Weigyi dam site is in an active armed conflict zone.
- The consequences of the dam will cause chronic misery for the Kayah people.
- The flood areas of the Weigyi, Dagwin and Hat Gyi dams lie fully within the Kayah-Kayin Montane Rainforest Eco-region, globally recognized as an area of outstanding biodiversity.
- A 2008 study of the Khoe Kay bend in the Thanlwin near the Weigyi dam site documented 194 plant species and 200 animals, 42 of which are considered endangered and including unknown and endemic species.

3.4 Dagwin Dam

- This is located on the border south of the Weigyi site and to the west of Mae Sariang town in Thailand.
- The height of the dam will be an estimated 56 m.
- With a projected capacity variously given as 500, 792 or 900 MW, the dam would produce electricity but would mainly serve to trap and regulate large amounts of water released by the Weigyi Dam during peak hours.
- It would use off-peak power to pump water back up into the upper dam.
- The cost of building the Dagwin dam is estimated at US$ 900 million.
- Electricity will be sold to Thailand.
- The Dagwin dam is currently in the planning and feasibility stages.

Impacts:

- In order to secure the area around the Dagwin site, Myanmar’s military has since the early 1990s launched several offensives against the ethnic Kayin villagers living in the vicinity.
- Before the offensives, the zone around the Dagwin site was a Kayin liberated area with a population of just over 100,000 people.
- Now more than half of those people have fled the area, many ending up in refugee camps in Thailand.
- A majority of those remaining have had to flee their homes and are living as internally displaced persons.
- The Weigyi (Upper Thanlwin) and Dagwin (Lower Thanlwin) dams together would flood about 3,200 hectares of prime forest land on the Thai side and about 5,600 hectares on the Myanmar side.
3.5 Hat Gyi Dam

- The first dam to be built will be near to Myaingyingu at a place called Hat Gyi in Kayin State, about 33 km downstream from the Thanlwin-Moei confluence.

- Here, there is a particularly powerful rapid that becomes a waterfall when the water flow is reduced in the dry season.

- It is also adjacent to and part of the Kahilu Wildlife Sanctuary.

- Construction of the Hat Gyi dam was expected to commence as soon as late 2007 and commercial distribution of electricity to Thailand is projected to begin around 2013 or 2014.

- The Thai and Myanmar governments have agreed under the Memorandum of Understanding to keep all data and joint studies on this project strictly confidential.

- The proposal is much larger than previous studies, increasing the flooded area, which is inhabited mostly by ethnic Thai, Kayin and Shan, and includes 2 official wildlife sanctuaries in Kayin State.

- A 1999 pre-feasibility study by the Japanese development consultant NEWJEC recommended “a low height, run-of-river dam having a capacity of 300 MW.”

- But on November 14, 2005, the Thai Energy Minister cited a new feasibility study where “electricity production could be increased to 1,200 MW.”

- Quadrupled output from the dam would indicate a substantially higher dam and therefore a much larger reservoir.

- The dam height will be 33 m, installed capacity 1,200 MW, and annual production 7,335 Gwh.

- Estimated cost of building the Hat Gyi dam is US$ 1 billion.

- Most of the electricity from the Hat Gyi dam is intended for sale to Thailand.

- It is also important to mention that with a larger reservoir the Thai authorities will be able more easily to divert floodwaters from the Thanlwin to a dam on the Yuam River at Mae Lama Luang, which is at an advanced stage of planning.

- Water from the Mae Lama Luang dam will be diverted through a tunnel into the Bhumibol dam in central Thailand.

**Impacts:**

- Dozens of Kayin villages will be directly impacted and/or relocated from the dam’s floodplain.

- Thousands more will suffer abuses from the Myanmar Army’s attempts to secure the site, which have resulted in several military offensives and a large build-up of soldiers in the area.

- This will likely result in a greater influx of refugees into Thailand.

- Renewed offensives since late 2005 have already resulted in further displacement of tens of thousands of Kayin villagers, many of whom have fled to the Thai border.
3.6. Water Diversion from the Thanlwin to the Chaophraya River

- In 2003 several alternative plans were drawn up to divert 2.2 billion cubic meters of water from the Thanlwin’s major tributaries – and potentially the mainstream itself – through systems of holding dams, huge pumps and long tunnels to the Bhumibol dam.
- One such plan is to divert floodwaters from the Thanlwin into the Mae Lama Luang dam on the Yuam, a major tributary of the Thanlwin, through a tunnel leading to the Bhumibol dam on the Chao Phraya River that runs through central Thailand.
- An adviser to Prime Minister Yingluck Shinawatra has recently tried to revive a Baht 200 billion project to build an 88-km tunnel linking Myanmar’s Thanlwin and Thailand’s Bhumibol dam.
- The tunnel, when built, would be able to send 3,000 m³ per second of water to the Bhumibol dam.
- The volume should be large enough to generate electricity.

4. Downstream Impacts

- The five dams planned for the Thanlwin in Myanmar threaten to permanently alter a way of life for over half a million people living downstream at the river’s mouth.
- Life in the unique ecosystem of the Thanlwin estuary, where the fresh water of the Thanlwin and its tributaries meets the salt water of the Katpali Sea (Andaman Sea), is interlinked with seasonal flows and daily tides.
- But, if the dams are built, downstream impacts, as studied elsewhere in the world, stand to break those links.

These impacts include:
1. Decreased sediment downstream reduces agricultural productivity in one of Myanmar’s rice bowls. The food security of not only the local population but also the hundreds of thousands that rely on rice exported from the area would be jeopardized.
2. Altered river flows may cause higher concentrations of salt water to travel further inland, further threatening agricultural crops.
3. Sudden and unnatural water surges caused by releases from dams upstream increase erosion, destroy islands, and make the river dangerous to local communities.
4. Changes in water quality, salinity, or seasonal flows are likely to make community water pools undrinkable and affect agricultural crops.
5. A decline in fish catches due to interrupted migrations will impact the protein source of the local diet and decrease biodiversity.
6. Dam breaks would be a disaster; the proposed dams lie on active earthquake fault lines.

Any one of these changes to the river would tip the balance fine-tuned over generations between self-reliant communities and their environment, leading to loss of livelihood and out-migration.

Yet, despite all these concerns and potential problems, those living downstream have not even been informed of the project, let alone participated in any decisions surrounding it.
5. Latest Developments

List of Planned Hydroelectric Dams on the Thanlwin River in Myanmar Using B.O.T. (Build, Operate and Transfer) System as of early 2013

<table>
<thead>
<tr>
<th>Name</th>
<th>MW</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kunlong (Upper Thanlwin)</td>
<td>1,400</td>
<td>4.3 miles upstream from Holi Village, Kunlon Township, Northern Shan State</td>
</tr>
<tr>
<td>Naungpha</td>
<td>1,000</td>
<td>Near Tarsanglyan Village, Tangyan Township</td>
</tr>
<tr>
<td>Mantaung</td>
<td>200</td>
<td>Maimaw Township</td>
</tr>
<tr>
<td>Mongton (Ta Sang)</td>
<td>7,110</td>
<td>Between Mongpan and Mongton townships, Southern Shan State</td>
</tr>
<tr>
<td>Ywathit</td>
<td>4,000</td>
<td>Near Ywathit Village, Bawlakhe Township, Kayah State</td>
</tr>
<tr>
<td>Hat Gyi</td>
<td>1,360</td>
<td>29 miles downstream from the confluence of the Thanlwin and Thaungyin (Moei) rivers, Hlaingbwe Township, Kayin State</td>
</tr>
</tbody>
</table>

Source: The Sixth Regular Session of the First Pyithu Hluttaw, 27 February 2013.

- All the above-mentioned hydroelectric power projects are to be built by 5 Chinese companies in cooperation with such national companies as:
  1. Goldwater Resources Ltd.,
  2. International Group of Entrepreneurs Co., Ltd. (IGOEC), and
  3. Shwe Taung Hydropower Co., Ltd.

- Naungpha, Mantaung and Ywathit have recently been added to the list of hydroelectric power projects planned.
- The Weigyi and Dagwin are no longer found on the list (Table 1)
- The Upper Thanlwin (Kunlong) and Hat Gyi hydroelectric power projects (Items 1 and 6) are to be implemented by Chinese companies together with EGAT, and are reported to have completed an MoU/MoA as well as EIA and SIA reports.
- The remaining hydroelectric power projects have MoU contracts and EIA and SIA reports are in progress; accordingly none has reached the stage of Joint Venture Agreement.
- The Ta Sang was started by the previous government in 1993 and was suspended in 2007 due to economic sanctions.
- During the 6th regular session of the 1st Pyithu Hluttaw in February 2013, the Deputy Minister for Electric Power mentioned that 6 new hydropower dam projects are planned for the Thanlwin to expand electricity production, but did not answer questions related to the Ta Sang project.
- It is not transparent why the new site for the Ta Sang dam is about 15 km away from the old one.
6. Potential Loss of Services Resulting from the Loss of the Free-flowing Character of the Thanlwin

<table>
<thead>
<tr>
<th>Services</th>
<th>Potential lost services as a result of loss of free-flowing character</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provision of Food and Freshwater</td>
<td>➢ Disruption of traditional fisheries</td>
</tr>
<tr>
<td></td>
<td>➢ Decreased downstream water quality</td>
</tr>
<tr>
<td>Regulation of hydrological regime, pollution control, natural hazards</td>
<td>➢ Natural connection between the Tibetan Plateau, Southwest China and Katpali (Andaman) Sea lost</td>
</tr>
<tr>
<td></td>
<td>➢ Increased risk of flooding as a result of dam operations</td>
</tr>
<tr>
<td>Cultural spiritual, recreational, aesthetic, and educational aspects</td>
<td>➢ Loss of the developing eco-tourism and white-water rafting industry</td>
</tr>
<tr>
<td></td>
<td>➢ Loss of cultural values for the Lisu, Nu, Shan, Kayin and other minorities</td>
</tr>
<tr>
<td>Support for biodiversity and nutrient and sediment cycles</td>
<td>➢ Biodiversity will be affected both in and alongside the river through construction-related infrastructure</td>
</tr>
<tr>
<td></td>
<td>➢ Sediment retention in reservoirs will affect channel erosion and stability of riverbanks</td>
</tr>
</tbody>
</table>

- From its headwaters in the Tibetan Plateau to its estuary in Myanmar, the Thanlwin supports over 10 million people.
- For many decades, it has been the longest free-flowing river in Southeast Asia.
- It supports a UNESCO World Heritage Site and sustains rich fisheries and farmlands central to the lives of many indigenous communities living along its banks.
- Large dam cascades in China and Myanmar are being planned in complete secrecy, with no participation from affected communities and no analysis of the cumulative impacts or seismic risks of these projects.
- China has also plans to build a 13-dam cascade on the river upstream in Tibet and Yunnan.
- Myanmar and Thailand are pushing for 7 dams and a water diversion project for the lower Thanlwin, despite ongoing conflicts near the dam sites between the Myanmar army and ethnic groups in Kayah, Kayin and Shan states.
- The Kunlong and Ta Sang dams in Shan State and the Weigyi, Dagwin, and Hat Gyi dams in Kayin State will have a combined installed capacity of over 14,000 MWs, and an estimated total construction of US$12 billion.
- The proposed Thanlwin dams will have many potential environmental and human impacts.
  - In addition to the Yin Talai, 30,000 people from Kayah State alone would be permanently displaced by the Weigyi dam.
  - The number of people that will be displaced by the 4 lower dams is estimated at 73,000 in Myanmar and 10,000 in Thailand.
  - Half a million people living in the Thanlwin delta will be affected by decreased sedimentation, possible salt water intrusion and changed water flows.
  - Hundreds of thousands of villagers have already been forcibly relocated from the some of the dam areas and will never be able to return.
Conclusion: Keep the Salween River Free

- The Thanlwin is one of the region’s last largely free-flowing rivers and is shared by China, Thailand, and Myanmar.
- Communities living downstream have voiced strong opposition to dam construction because millions depend on the Thanlwin to sustain their fisheries and farmlands.
- Dam projects on the Thanlwin should be halted pending a full Strategic Environmental Assessment (SEA) of the entire Thanlwin basin.
- The cumulative impact of these dams, if not assessed and addressed, could spell disaster for an area that is rich in biodiversity, seismically active, and crucial to the survival of over 10 million people from source to sea.
- While none of these dams have been approved, site preparation has already started on at least two sites in China (at Songta and Maji).
- Farther downstream, the dams in Myanmar are located in conflict areas that continue to experience much unrest.
- Dams themselves have been linked to cases of human rights abuses and widespread environmental damage.
- Before these projects are allowed to move forward, the governments of China, Myanmar and Thailand should:
  1. Jointly carry out a comprehensive strategic environmental assessment of the Thanlwin basin, in order to determine:
     (a) The ecological and economic values of the entire basin; and
     (b) The cumulative impacts that large-scale dam-building may have on these values.
  2. Explore alternative means to meet the energy demands of Myanmar, through:
     (a) Investing in energy efficiency and end-use conservation;
     (b) Alternative energy sources; and
     (c) Strengthening implementation of existing laws and policies on energy, environmental protection, and resettlement.
  3. Inform affected communities and the general public of all plans regarding hydropower development and include them in the decision-making process. This includes publicly releasing:
     (a) Dam feasibility studies;
     (b) Environmental Impact Assessments (EIAs);
     (c) MOUs, MOAs; and
     (d) Investment and financial agreements.

Save the Thanlwin River and the millions upstream and downstream that it sustains, if possible
Vegetational study of Thanlwin River Basin at Kunlong Hydropower Project

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Botanist

INTRODUCTION

• Myanmar occupies an area of 678,033 sq. km in Southeast Asia. It is bordered by India, Bangladesh, and the Bay of Bengal on the west, China to the north and northeast, Laos and Thailand to the east and the Andaman Sea to the south. With the exception of the centrally located Ayeyarwaddy valley and delta, the most populated area, the terrain is generally hilly and mountainous. The climate is mostly monsoonal.

• There are four main rivers in Myanmar, namely the Ayeyarwaddy, Chindwin, Sittaung and Thanlwin Rivers. The study area is located in one of the main rivers, the Thanlwin, which possesses the best opportunities for hydro-power generation due to the steep gorges along the river banks. Shan State is the most northeastern state in Myanmar, with a tropical region running through its southern part. The southern part of the region forms part of the Shan Plateau. The state borders Yunnan Autonomous Region and Mandalay Division in the west, and Kachin State in the northwest.

• The major type of forests occurring in the study area is Tropical Wet Evergreen Forest (Stamp 1924). It is characterized by the presence of the genera 
  *Duabanga*, *Michelia*, *Betula*, *Tetrameles*, *Dillenia*, *Ficus*, *Spondias* and *Broussonetia*. Another characteristic feature is the presence of bamboo species. Many ferns are also present.

• The terrain is largely mountainous, especially in the north and west. A series of high mountain ranges spreads through the area in a north-south direction. There is a distinct canyon region to the south and plateau region to the west. The region’s major rivers flow through deep valleys between the mountains.

• The average elevation is 1,980 m. The mountains are highest in the north where they reach more than 2,000 m; in the south they do not rise higher than 1,500 m. Kongyan Township is the highest at about 2,039 meters, and the lowest is in the Thanlwin valley at an elevation of 466 meters.

• The southern half of the region is the limestone Shan plateau with un-navigable rivers flowing through deep mountain gorges; the northern half is characterized by mountain ranges and rivers running north and south.

• The region has a generally mild climate with pleasant and fair weather because of its location on south-facing mountain slopes, receiving the influence of both the Pacific and Indian oceans. The average January temperature ranges from 8°C to 17°C, while the July average varies from 21°C to 27°C. The plateau has moderate temperatures. Average annual rainfall ranges from 600 mm to 2,300 mm, with over half the rain occurring between June and August. The northern canyon region is hot and humid at the valley bottoms, but with freezing winds at the mountain tops.

The study area (Northeast Shan State)
The study area is situated in Huli village of Kunlong Township in the upper reaches of the Thanlwin River of the Union of Myanmar. A simple highway connects the study site and Huli village in Chinese territory.

The Kokang area (Special region)
Kokang Special Region or Kokang Township is in the northwest highlands of Myanmar, with five administrative regions and 17 villages. The population is 320,000 and its total land area is 2,700 km². Kokang is inhabited mainly by the Kokang people. Other ethnic groups include the Shan, Miao, Va, Lili and Kachin. Kokang is located in the Mali Basin and has limited farmland. It produces mainly upland rice. Rice for cooking is mainly imported from China or other regions of Myanmar. Other produce includes rubber, leaf tea, corn, kale, pineapple and sugar cane.
Potential impact of the dam on tree species

The flooded area (1,388 ha) of the dam is at a low percentage compared to the vegetation in the total study area. Two species listed as globally threatened were recorded from the sample study sites representing the whole study area. The record indicates that these trees can also be found in areas outside the study area which bear the same vegetation. Although these trees are listed as globally threatened, there will be no serious impact due to the construction of the dam as they can also be found in areas unaffected by the construction of the dam.

Vegetational Study in Thanlwin River Basin in Kayah State

Kayah State

- The present study area is in Lawpita Township, Kayah State, located in the Thanlwin River basin in Kayah State in the south-east part of Myanmar.
- The area of Kayah State is 11,266.45 km² (4,530 square miles) with a population of 168,355 in seven townships. It is inhibited by the Kayin, Chin and the majority Kayah. The majority of the population is Buddhist or Christian with an animist minority. The state comprises Loikaw and Bawlakhe districts and includes seven townships: Loikaw, Demoso, Hpruso, Shadaw, Bawlakhe, Hpasaung and Mese. The state has 86 village tracts and 620 villages.
- The Baluchaung is large enough to consider a large river. It runs more than 217 km through Shan State and Kayah State, joining the Pawn Chaung in Lawpita Township, and the Thanlwin River in Kayah State.

Vegetation in the Baluchaung Catchment Area

- The Baluchaung can be divided into the upper Baluchaung, from the Pinlong Mountain Range in Pinlong Township, Shan State, to Inle Lake in Naung Shwe Township, and the lower Baluchaung from Inle Lake to the confluence with the Pawn Chaung in Lawpita Township in Kayah State.
• The height of the Pinlong Mountain Range averages about 1,500 m. From Pinlong Mountain, the Baluchaung runs to the east and enters Inle Lake through three branches, the Intain-chaung, Inle-ywar-ma-chaung and Ywar-gyi-chaung.

• According to its morphological characteristics, it can be divided into three sections.

• The forests in the area are deciduous forest, mixed deciduous forest (semi-evergreen and riverine), dipterocarp forest and scrub land (bamboo mixed deciduous forest according to our present study). It also conforms to the type of vegetation in the catchment area of the central Moebye Basin based on UTM maps and UTM zone 47 N, WGS 84, coordinate system, comprising dry deciduous forest, semievergreen forest and scrub land with bamboo. The present assessment, within the Loikaw-Lawpita basin, of vegetation cover along the tunnel, vegetation along the banks of the lower Baluchaung and vegetation cover in the catchment area between BLC2 HPP and BLC3 HPP, confirms that the type of vegetation is deciduous forest dominated by dipterocarp species on high mountain elevations of up to 2,000 feet in the catchment area of the east bank of the Baluchaung and along the tunnel, and bamboo forest dominated by Dendrocalamus membranaceus Munro, Thrysostachys siamensis (Kurz ex Munro) Gamble on the slopes.

• The dominant tree species in this area is Shorea obtuse (Thit-ya), Shorea siamensis (In-gyin), Dipterocarpus tuberculatus (In) and Xylia xylocarpa (Pyin-ka-doe).

• Almost all the forests in the studied area are degraded secondary forests occupied by small trees with <40cm in DBH and <10m in height. But three very big teak trees were found near Lawdalay village, conserved due to a belief in a living supernatural guardian of the trees. This shows that there was once a large teak forest in this area, which is also confirmed by the presence of some relatively large teak trees in the area occupied by the project site and the report of WWF.

• It is also confirmed that the forests in the studied area are degraded due to over exploitation. The commercially valuable tree species such as Tectona grandis (Teak), Xylia xylocarpa (Pyin-ka-doe), Hopea odorata (Thin-gan) and Pterocarpus macrocarpus (Pa-dauk) are rare in the study area. These species should be conserved and reforested in the area.

Potential Impact on Flora

• In eco-regions which are nationally important, regionally significant and globally outstanding, wildlife species will be heavily disturbed and directly affected by clearing for construction of infrastructure, illegal and legal logging and plantation of monoculture crops like banana. The watersheds of the upper Baluchaung including Inle Lake and central Moebye Basin are core areas for biodiversity conservation. Since these areas including the Loikaw-Lawpita Basin are within two eco-regions, (Map VII), key biodiversity area (Map VIII) and conservation corridor (Map IX), biodiversity conservation is essential. Definitely there will be negative impacts on the potential availability of traditional medicinal plants. Local hunters also use small scale forest fires to drive game out of hiding. This practice should be prohibited by changing their livelihood.
Recommendations and Mitigation Measures

- To establish plans to arrest continued loss of biodiversity.
- To continue research to resolve taxonomic and ecological information inadequacies that hamper conservation.
- To take measures to maintain a set discharge volume of water into the natural flow of the Baluchaung, avoiding zero discharge except in very extreme emergencies.
- To sustain water quality with appropriate temperature, oxygen, turbidity and sediment levels for the well-being or survival of aquatic plant and animal species.
- To take measures to minimize soil erosion in watershed area.
- To establish reforestation and soil conservation in watersheds.
- To establish a plan for teak plantations to compensate for the removal of teak plantations at the project site.
- To ban legal and illegal logging and charcoal production in the areas concerned.
- To establish a protected area in the watershed of the upper Baluchaung.

Immediate Compensatory Measures

In the utilization of resources in the region, responsibility lies with those who consume the resources. This responsibility is to conserve the natural environment and to develop the socio-economy of local peoples. Now it is established that there will be negative impacts on the two regionally significant and globally outstanding eco-regions, one a centre of world plant diversity, and that some livelihood activities of local peoples have negative impacts on the environment, the following compensatory actions should be prioritized when electricity is generated.

Prioritized Action I

- Create and implement new protected area management and water-shed management in the entire watershed area of the Baluchaung. High Tech Concrete Technology Co., Ltd. (HTCT) will provide funds for protected area management and watershed management. Both the Ministry of Electric Power and HTCT are responsible for raising a “Conservation Fund”. Approximately 0.5% of the annual proceeds from the sale of electricity will go to the Conservation Fund. This Fund should be managed by the Nature and Wildlife Conservation Division of the Forest Department.

Prioritized Action II

- With respect to impacts on forests within the Central Moebye Basin and Loikaw-Lawpita Basin, funds will be provided to reforest and rehabilitate priority sites that have been degraded due to logging and construction infrastructure in the project area.

Prioritized Action III

- The socio-economic development of local peoples will be undertaken under the social responsibility ethic of the investment companies. In this regard, both the Ministry of Electric Power and HTCT should raise a “Socio-economic Development Fund” as a benefit sharing for local people. This fund should be managed and implemented by representatives of the local government of Kayah State. Approximately 0.5% of annual proceeds from the sale of electricity will go to the Socio-economic Development Fund.

Special Notes

- The Thanlwin is an international river. The Salween basin covers 320,000 km². The watershed area is located in China (53%), Myanmar (42%), and Thailand (5%).
- It is called the Nu Jiang (Nu River) in Chinese, Nam Kong (Kong River) in Shan, and Thanlwin in Myanmar. “Thanlwin” was pronounced “Salween” by the British and this name in English remains today. It is a much longer river than the Ayeyarwaddy.
- The most important issue is the procedure for transboundary environmental impact assessment (TEIA) concerning the proposed hydropower dams on the Thanlwin River located within China or physically across the Chinese border.
- The immediate compensatory measures require discussions with the Chinese authorities on their responsibility concerning transboundary impacts and the signing of an MOU to carry out a joint environmental impact assessment on the Thanlwin River Basin (downstream under Myanmar sovereignty).
1. **Introduction**

   - The Thanlwin (Salween) river is approximately 2,800 km long, with a sediment discharge of $100 \times 10^6$ t yr$^{-1}$, a water discharge of $300 \times 10^9$ m$^3$ yr$^{-1}$ and a drainage basin area of $0.28 \times 10^6$ km$^2$ (Nyi, 1967; Bender, 1983; Milliman and Meade, 1983; IUCN, 2003 and Meade, 1996).

2. **Location**

   - The Thanlwin river mouth study area is situated in the western part of Mon State.

3. **Aim and Objectives**

   - To point out the relationship between suspended sediment concentration and hydrodynamic conditions of the river mouth at different times; and
   - To reveal the relationship between estuarine sedimentation and tidal/river processes.

2. **General Geology**

   Regional geologic setting

   - Myanmar can be subdivided north-south into linear geotectonic provinces; from east to west, the Eastern Highlands (Shan-Tanintharyi Block), the Central Cenozoic Belt, the Western Ranges and the Rakhine Coastal Belt (Thein, 1973).
   - The study area is situated in the southwestern part of Shan-Tanintharyi Block.
   - According to the regional geologic setting map, the sediments of the study area may for the most part belong to pre-existing metasedimentary rocks, low to high grade metamorphic rocks and intrusive igneous rocks.

3. **Materials and Field Methods**

   - During field trips, 44 specimens of surface sediments were collected both in the Thanlwin river mouth and along shore lines by using the grab sampler.
   - To study the channel bathymetry, suspended sediment concentration and current velocity variation at different times, a sampling area was chosen in the Thanlwin river mouth between Mottama and Yekeyun.

4. **Results**

   **Suspended sediments**

   - In flowing waters, the deposition of suspended sediments onto the substrate usually occurs when velocity decreases to the point that sediments can no longer be transported.
   - The intrusion of fine sediments into a gravel streambed is determined by discharge, water depth, velocity, rates of sediment transport and the initial concentration of suspended sediment (Beschta and Jackson, 1979; Paustain and Beschta, 1979).
From the data collected on August 9, 2010, the amount of suspended sediment concentration carried by surface river water is generally low in the eastern part of the channel and rather high in the western part.

On August 24, 2010, the amount of surface suspended sediment concentration gradually decreases from north to south.

On September 7, 2010, the amount of suspended sediment concentration carried by surface river water is conspicuously higher in the western part than in the eastern part.

A surface current velocity contour map for August 9, 2010 shows that surface current velocity is generally high in the northeastern part of the channel but rather low in the southwestern part.

On August 24, 2010, the surface current velocity is generally high in northeastern, eastern and southwestern parts of the channel but conspicuously low along the western and southeastern parts.

On September 7, 2010, the surface current velocity is generally high in the northeastern, eastern and southwestern parts of the channel but conspicuously low along the western and southeastern parts.
Channel bathymetry

- With regard to the bathymetric study, in the southernmost part of the area, according to the data collection sites of line 1, the main current diverges and a deeper channel occurs in the western part with a shallower area on the eastern side.

- In the central part of the area, i.e., data collection sites of line 2, the deeper part of the asymmetrical channel is located on the eastern side and thick accumulation occurs on the western side.

- On the northernmost section line (line 3), a deeper channel develops in the eastern part while the central portion of the river is thought to be covered by sediment bars with larger particles than the westernmost area.

- Overall bathymetric condition reveals that the central portion of the study area is deeper than the southern end where tidal influence should be considered as a factor because it is closer to the open sea.
Interpretation

- According to the research data, the areal wide SSC shows higher concentrations mostly in the western area where the bending river course favours deposition.
- The outer concave area located in the eastern part of the area resembles an erosion regime rather than deposition, leading to bank erosion.
- From a bathymetric point of view, the deeper channel exists in the eastern part of the area where the current velocity is somewhat higher.
- In this part, suspended sediment is easily transported by the higher velocity current as data in the present work was collected during the downstream period under low tide conditions.
- In the channel area, with the higher velocity of current, the deposition of larger sediment (grit and pebbles) can be compared with the estuarine model proposed by Reading (1996).
- It is assumed that there are sand flats beside the main channel and mud flats located in the outer area where the velocity apparently decreases together with larger particles of the main depositional system in the channel floor.
- The study area somewhat resembles to the model proposed by Dalrymple et al. (1992) in which the central estuary is a mix of energy from river currents and marine processes.

Sediment facies analysis

- In the present study, five sediment facies occur, each with distinct characteristics.
  - Sand facies
  - Silty sand facies
  - Gravelly sand facies
  - Mud facies
  - Salt marsh facies

**Sand facies**
- This type of sediment is generally found in the whole study area, especially along the shore lines of western Bilugyun, the upper and lower parts of the Thanlwin river mouth.
- This facies is laterally associated with muddy sediments but in some localities it is observed in association with the gravelly sand facies.

**Silty sand facies**
- This facies is mainly found in the lower part of the Thanlwin river mouth.
- These sediments are associated with sand, mud and marsh facies.
- The main considerations for the deposition of silty sand facies in lower part of the Thanlwin river mouth are decreasing current velocity and density contrasts between river and basin water.

**Gravelly sand facies**
- The general characteristics feature of gravelly sand are observed in the north eastern part of the Thanlwin river mouth and Kalwi seak.
- In the Mawlamyine and Kawli seak areas, gravelly sand can be observed as a long narrow belt when it exists in the deeper part of the Thanlwin river mouth.
Mud facies

- Mud facies are confined to areas along the coast of western Bilugyun and widening to cover most of the southern end eastern side of the Thanlwin river mouth, around the Hintha kyun, east of Kawmupun and around the Mottama bank.
- This facies is mostly associated with sand, silty sand and salt marsh facies. This type of sediment mostly occurs as long narrow strips and as wide and extensive flats. Sometimes, these sediments present in tidal creeks at the upper reaches of tidal water.
- This characteristic distribution of the sediment on muddy intertidal flats is the result of the low energy and partly the transport mechanism.
- Low velocity currents allow fine-grained sediments to settle out. Major mud deposition takes place in the muddy intertidal flat near the high-water line, mainly because of low wave and current energy in this part.

Salt marsh facies

- This is mostly found in areas of the south eastern part of the Thanlwin river mouth.
- Wide and extensive salt marshes are located in the western Bilugyun area.
- They are also found in long and narrow strips in some areas of the eastern flank of the Thanlwin River mouth. Much smaller patches are present at the mouths of many tidal creeks entering the Thanlwin River and in depressions in eastern Bilugyun.
- This type of sediment is mostly associated with mud facies and occurs between land and the muddy sediments.
5. Discussion

- The study area of the Thanlwin river mouth and nearby shorelines situated in the western part of Mon State represents the different sediment distribution patterns and diverse sediment types. In the present study, sedimentation patterns and their hydrodynamic conditions, and sediment distribution under different flow conditions superimposed by marine influence are the prime focus of the study.
- In the present study, materials and methods are the main categories to be considered in accordance with the facilities available.
- Moreover, the sample collection period is also considered a major factor due to the mountainous catchment area with considerable precipitation.

  - **Suspended sediments and current velocity:** Suspended sediments can be deposited when velocity decreases to the point that sediments can no longer be transported. Although sediments can be deposited by hydrodynamic power, suspended sediments occur in the water of the area.
  - It is found that suspended sediment concentration is inversely proportionate to surface current velocity.

  - **Channel bathymetry:** Section line C-C΄ has a deeper channel area on the eastern side. In section line B-B΄, the deeper channel is also located on the eastern side with a deepest area 15 m.
  - At section line A-A΄, located just north of the Yelekyun, the channel becomes shallower and wider. In the middle part of the channel, channel bar is well developed parallel to current direction and can be regarded as like channel found in the lower reaches of tide-dominated estuaries.

  - **Sediment facies analysis:** Sediment facies analysis reveals area-wide sediment distribution.
  - In the present study five sediment facies with distinct characteristics can be observed.
  - Sand facies occupy a wide area especially in the areas such as western Bilugyun, and the upper and lower parts of the Thanlwin river mouth.
  - The deposition of sand tends to require more energy than mud, indicating the influenced of significant conditions.
  - In some areas, sand deposition also associated with mud facies somewhat resembles tidal mud flat deposits.
  - The bathymetric study shows submerged bars in the Thanlwin river mouth more or less parallel to current direction, the product of a tide-dominated estuary.
  - The salt marsh facies occupying the study area is a supratidal deposit located above the high water line.
Biodiversity of the Thanlwin/Salween River: 
Species lists of plankton and nekton 
from Kunlon area, Shan State, Myanmar

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Renewable Energy Association Myanmar (REAM)

1. ABSTRACT
A survey of plankton and nekton in the Kunlon area of the Thanlwin (Salween) River, Shan State, Myanmar, was carried out from April to May 2010. The surveyed sites were situated upstream of the Thanlwin River and Nam-tit tributary confluence near the Myanmar-China border in northeastern Shan State. The data were collected from the main river and its tributaries in the survey area. A total of 346 species of phytoplankton, 186 periphyton, 58 zooplankton and 54 fish species were recorded in the survey. 31 kinds of benthos were also found in the survey area.

2. INTRODUCTION
The Thanlwin (Salween) River originates in the glaciers in the Qinghai Mountains of the Tibetan Plateau, parallel to the headwaters of the Mekong and Yangtze, and then flows east through Sichuan, then south through western Yunnan province of southwestern China. It runs and cuts a series of 1,000-metre deep gorges through the Shan Plateau in Shan State and Kayah State in Myanmar, along the Myanmar-Thai border, and through the southern plains of Myanmar in Kayin State and Mon State before discharging into the Andaman Sea at the Gulf of Mottama (Martaban) near Mawlamyine, southeast of the Sittaung River mouth in Myanmar and it deposits its glacially-originated sediments on an extensive delta at the mouth. In Myanmar and Thailand, the Thanlwin basin topography is mountainous, with long narrow river valleys. The length of the Thanlwin River is about 2,815 kilometres. The Thanlwin basin covers 320,000 sq km, and its location is latitude 16°15'-33°15' N, longitude 91°00'-100°00' E. The basin is rich with natural resources, including water (surface and ground), forest, wildlife, fish and aquatic life, and minerals. Many tributaries of different length including the Nam-tit, Nam-pang, Nam-hsin, Nam-tan, Nam-belu, Paunglaung, Yonzalin, Don Tham, Gyaing, Ataran and Thaungyin tributaries which join the Thanlwin River in Myanmar in cascades. The Thalwin River is known by different names in different areas: “Nu Jiang” in Tibet and China, “Thanlwin” in Myanmar and “Nam Kong” among local peoples in Thailand and Myanmar. It is the only major river in this region that still runs freely. The Thanlwin River, because of its rapids, is navigable for less than 160 km (100 miles) from the sea. The study area covers between latitude 23°23’50.8” N and 24°05’23.0” N of the river in Myanmar.

There has been no previous proper survey of aquatic organisms in this area of the Thanlwin. This is the first systematic survey on aquatic organisms of this area.

3. SURVEY AREA
The survey area is situated on the Thanlwin River in the northeastern part of Shan State near the Myanmar-China border. 20 stations were designated and survey work carried out in April and May 2010. Investigation on major branch tributaries covered 5-10 km above the confluences.

4. MATERIALS AND METHODS
The exact location of each surveyed site was fixed using GARMIN GPS models etrex-Legend Cx.

Phytoplankton was collected using 25# mesh and zooplankton using 13# mesh plankton nets and preserved in formaldehyde solution. Some delicate samples were collected with 25# mesh plankton net and fixed with Lugol's solution. Benthos was collected using 500 μm mesh D-shape kick-net and preserved with formaldehyde solution. Periphyton samples were taken from submerged stones and preserved in formaldehyde solution for further identification.
Fish samples were bought from the local fishermen and markets. A cast net was also used whenever possible for catching fish. Samples were preserved with formaldehyde solution for further identification.

5. RESULTS

5.1. Aquatic organisms

The investigation of aquatic organisms other than fish included microscopic organisms, phytoplankton, zooplankton and periphyton, as well as macroscopic invertebrates, the benthos.

346 species of phytoplankton; 58 species of zooplankton; 186 species of periphyton and 31 kinds of larval benthos were identified and recorded. The species for each ecological group, namely phytoplankton, zooplankton, periphyton and benthos were recorded in qualitative lists given below.

5.1.1. Phytoplankton:

A total of 110 genera and 346 species from 5 phyla are recorded from this survey. The taxonomic group that predominated the phytoplankton of the survey area was Bacillariophyta (149 species), followed by Chlorophyta (95 species) and Cyanophyta (45 species). Euglenophyta and Xanthophyta were represented by only 10 species and 2 species respectively. Dinophyta (Pyrrophyta), Chrysophyta and Cryptophyta were not found in this study. The species composition is shown in Table 1 & 1.1.

Table (1.1) Phytoplankton species composition and percentage

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Bacillariophyta</th>
<th>Chlorophyta</th>
<th>Cyanophyta</th>
<th>Eugleno-phyta</th>
<th>Xanthophyta</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>194</td>
<td>95</td>
<td>45</td>
<td>10</td>
<td>2</td>
<td>346</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>56.07</td>
<td>27.46</td>
<td>13.01</td>
<td>2.89</td>
<td>0.58</td>
<td>100</td>
</tr>
</tbody>
</table>

5.1.2. Periphyton:

There are 63 genera and 187 species under 4 phyla of periphyton recorded from the Kunlon Dam area. Among them, phylum Bacillariophyta is dominant with 114 (135) species. Phylum Chlorophyta is second with 30 species recorded. The highest composition of phylum Bacillariophyta is 72.73% (Table 2 & 2.1).

Table (2.1) Periphyton species composition and percentage

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Bacillariophyta</th>
<th>Chlorophyta</th>
<th>Cyanophyta</th>
<th>Euglenophyta</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>135</td>
<td>30</td>
<td>19</td>
<td>2</td>
<td>186</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>72.58</td>
<td>16.13</td>
<td>10.22</td>
<td>1.07</td>
<td>100</td>
</tr>
</tbody>
</table>

5.1.3. Zooplankton:

58 species from 4 phyla were recorded from this survey, composed of 44 species from phylum Protozoa, 7 species from phylum Trochelminthes, 6 species from phylum Arthropoda and 1 species from phylum Nemathelminthes. The highest species composition is from Protozoa and the percentage is about 75.86% (Table 3 & 3.1).

Table (3.1) Zooplankton species composition and percentage

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Protozoa</th>
<th>Trochelminthes</th>
<th>Arthropoda</th>
<th>Nemathelminthes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>44</td>
<td>7</td>
<td>6</td>
<td>1</td>
<td>58</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>75.86</td>
<td>12.07</td>
<td>10.34</td>
<td>1.72</td>
<td>100</td>
</tr>
</tbody>
</table>

5.1.4. Benthos:

31 kinds from 4 phyla of benthos were recorded from the survey area. Among them, phylum Arthropoda is dominant with 10 orders found from this phylum. The composition of phylum Arthropoda is about 83.87% (Table 4 & 4.1).

Table (4.1) Benthos species composition and percentage

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Arthropoda</th>
<th>Mollusca</th>
<th>Annelida</th>
<th>Platyhelminthes</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>26</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>Percentage (%)</td>
<td>83.87</td>
<td>9.68</td>
<td>3.23</td>
<td>3.23</td>
<td>100</td>
</tr>
</tbody>
</table>
5.2. Fish

54 species from 10 families were recorded from this survey. 2 species cannot be identified into species level. These unidentified species have to be studied in detail in the future.

Fish were caught by drift nets set by local fishermen on the bank of the river in the evening and harvested in the morning along the river. Set drift nets of various mesh sizes are common fishing gear in the region. The length and the depth of drift nets depend on the fishing area. The most commonly used fishing nets are 2.5 to 5 inches drift nets. Nets of larger mesh size of 5-8 inches were used in the past but cannot now be used because of the smaller number of fish caught. The common length of fishing nets is 14 to 20 meters and depth is about 2 meters. Fishing hooks are also used in some parts of the river and tributaries.

6. DISCUSSION

6.1. Aquatic organisms

Planktons are of great significance in the ecology of the aquatic environment. Phytoplankton is the grass of the aquatic region or the primary producer. The zooplankton, the primary consumer, grazes upon phytoplankton and is in turn consumed by other larger animals including fish. Periphyton are the basic food for benthic or bottom dwelling fish. The food base of streams within riparian forests is mostly derived from the trees, but wider streams and those that lack a canopy derive the majority of their food base from algae. In the aquatic food web, algae are a fundamental part of the system.

Algae, consisting of phytoplankton and periphyton, are the most significant sources of primary production in most streams and rivers. Phytoplankton floats freely in the water column and is unable to maintain population in fast-flowing streams. They can, however, develop sizable populations in slow-moving rivers and backwaters. Periphytons are typically filamentous and tufted algae. They can attach themselves to objects to avoid being washed away by fast currents. In places where flow rates are negligible or absent, periphyton may form a gelatinous, unanchored floating mat. Surviving in unpolluted flow water can be beneficial to plants and algae because the current is usually well aerated and it provides a continuous supply of nutrients. Phytoplankton and periphyton composition and distribution are limited by flow, light intensity, water chemistry, substrate, and grazing pressure. These organisms exhibit limited adaptations to fast flow and are most successful in reduced currents.

The species composition of phytoplankton in the Thanlwin River mainstream is higher than in its tributaries. This means that the water quality of Thanlwin River is at the present moment good with no chemical pollution around the watershed area of the river. The only limiting factor to phytoplankton and periphyton production in the Thanlwin mainstream is water turbidity. The overall density of the phytoplankton was found to be relatively low. This is due to the turbidity of the water which cannot provide optimum photosynthetic conditions for phytoplankton. Another fact is that the

Economically important fish species recorded in surveyed areas
fast flowing and turbulent water column does not favour high population density for phytoplankton. The lotic condition of the water also does not favour the formation of large and elaborate colonies. Taxa that are known to exist in colonial form in lakes and ponds were rare here, and when present they were mostly in solitary forms. Blue green algae species that exist in large colonies were absent, and only a small colonial form of *Microcystis incerta* was found. Large colonies of *Volvox* species were absent but only small colonial type *Eudorina* species was present.

Higher periphyton species composition in the tributaries depends on reduced flow rate, light intensity and good environmental conditions of the watershed area. Because of the high flow rate and high turbidity, periphyton species composition of the Thanlwin mainstream is lower than in the tributaries. Very few species are found in some parts of the river.

Bacillariophyta (Diatoms) greatly predominated the periphyton of the study areas (135 species), followed by Chlorophyta (30 species) and Cyanophyta (19 species). Euglenophyta was represented by only 2 species. A comparison of biodiversity status of the Thanlwin mainstream and its tributaries shows that the tributaries have a higher diversity than the Thanlwin River.

With regard to the phytoplankton and periphyton taxonomic study in the area, the issue of “similarity” was noticed. That is, the same species of certain diatoms, green algae and blue-green algae were found both in phytoplankton and periphyton. After review, a weak point in the collection methods for periphyton was observed. Periphyton collected from the undersurface of a submerged stone or boulder were put into a sample bottle together with a small amount of river water. Certain ubiquitous phytoplankton species can, in one way or another, unexpectedly get into the periphyton sample. On the other hand, it should be realized that in a fast flowing and turbulent water it is very difficult to draw a clear cut demarcation line between phytoplankton and periphyton. Because of undercurrents and turbulence, some periphytonic species can be easily detached from their original habitats, drift in the water, become temporary phytoplankton and eventually be taken in the plankton net.

Zooplankton and benthos species composition in the tributaries and Thanlwin mainstream do not differ. Because of the fast flowing water in surveyed areas, organisms suspended in the water column such as zooplankton cannot maintain high densities.

58 species of zooplankton including 2 kinds of larvae were identified and recorded. They were represented mainly by two taxonomic groups, Protozoa and Rotifera, and to a much lesser extent, Crustacea. Crustaceans such as Cladocera and Cyclopoida which are typical and prominent in lakes and ponds were entirely absent here. It was observed that zooplankton were scarce in the surveyed areas. The lotic condition and turbid water which limits photosynthetic activities leading to low phytoplankton density ultimately contributes to the low population density of zooplankton. This means the biodiversity status of these two habitats is equal.

Due to the limited literature available, only 31 kinds of benthos could be identified. 26 kinds of larvae of aquatic insects overwhelmingly dominated the composition of benthos. Of these 26, only 19 could be identified down to the family level (19 families), while the remaining 7 could be identified only to the order level. The composition of benthos also included 1 kind of Oligochaeta, 1 kind of Nematoda, 2 kinds of Gastropoda and 1 kind of Bivalvia (larvae only).

This is probably the first investigation into aquatic insect larvae by Myanmar scientists. With the sole exception of a preliminary investigation made by Chinese scientists in the upper reaches of the Ayeyarwaddy River in 2009, there is no record, so far, of the aquatic insect larvae of Myanmar. Much work needs to be done on the systematics of aquatic insect larvae of the Thanlwin River, in particular, and the aquatic environment of Myanmar in general.

Primitive plants such as mosses attach themselves to solid objects. This typically occurs in most parts of the surveyed areas where a rocky substrate in humid areas offers attachment sites. Mosses are common on the rocky banks along the surveyed areas.

Insects are the dominant invertebrates of benthos in lotic systems. These species exhibit tremendous diversity and can be found occupying almost every available habitat, including the surfaces of stones, deep below the substratum, adrift in the current, and in the surface film. Insects have developed several strategies for living in the adverse flows of lotic systems. Some avoid high current areas, inhabiting in the substratum or the sheltered side of rocks. Like most of the primary producers, lotic invertebrates often rely heavily on the current to bring them food and oxygen. Invertebrates, especially insects, are important as both consumers and prey items in a lotic system.

At the moment, chiefly aquatic benthos insects could be identified only to the family level due to limited literature. One day, when appropriate literature is available, attempts will be made to identify these larval insect to genera or even species level. Some species may be typical of coldwater environments especially in the Indo-Burma biodiversity hotspot region. International study programmes have to be conducted to maintain the aquatic biodiversity of this region.
6.2. Fish

Fish are the best known inhabitants of lotic systems. The ability of fish species to live in flowing waters depends upon their swimming speed and the period they can stay in running water. This ability can vary greatly between species and is tied to the habitat in which it can survive. Continuous swimming expends a tremendous amount of energy and, therefore, fishes spend only short periods in the full current. In fast flowing water, individuals remain close to the bottom or the banks, behind obstacles, and sheltered from the current and swim in the current only to feed or change locations. Some species have adapted to living only on the bottom, never venturing into the open water flow. These fishes are dorso-ventrally flattened species such as *Balitora burmanica* and *Bagarius yarrelli*, to reduce flow resistance and often have eyes on top of their heads to observe what is happening above them. Some also have sensory barbels such as *Tor* sp. and *Neolissochilus* sp., positioned under the head to assist in the testing of substratum. Most of the fish species dominant in this survey were benthopelagic and demersal species.

Ovary matured specimen species such as *Glyptothorax* sp. and *Scaphiodonichthys burmanicus* collected from the Kyin-pae-haw tributary and *Neolissochilus stracheyi* caught near Holi village in May would be related to higher temperatures in that season. The spawning season of most fish species is related to higher water temperature and availability of sufficient food. The recorded temperature from specimen collection sites was about 24.0°C in the morning and 28.0°C in the evening in the Kyin-pae-haw tributary and 22.5°C in the Thanlwin mainstream near Holi village; these temperatures are sufficiently favourable for ovary maturation.

FishBase records about 147 fish species from Thanlwin basin. Based on FishBase data it could be stated that 23 species out of the 54 of this survey are new records for this river. 11 endemic fish species were recorded in FishBase but only 3 endemic species are recorded in this surveyed area. Long migrants of *Anguilla bengalensis* and *Tor tambroides* were recorded in the surveyed area. There is no IUCN status fish species recorded in this surveyed areas. Among the recorded lists, *Bagarius yarrelli*, *Eutropiichthys vacha*, *Pangasius pangasius*, *Clupisoma pratteri*, *Hypsibarbus salweenensis*, *Cyprinus intha*, *Neolissochilus stracheyi* and *Tor* species are the economically important species.
Prawn and shrimp resources of the Thanlwin/ Salween River mouth and adjacent waters

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Abstract
This paper gives a classified list of prawn and shrimp species found in the Thanlwin (Salween) River mouth and adjacent waters from October 2008 to May 2011. A total of 36 species (10 penaeideans and 26 carideans) belonging to 13 genera and 6 families were recorded. Among them, five species namely Macrobrachium inflatum, Palaemon semmelinkii, Palaemon serrifer, Atyopsis moluccensis and Caridina bakoensis were recorded for the first time. One species of Caridina was identified up to genus level. Moreover, station-wise distribution of prawn and shrimp species and short notes on the status of commercial prawns and shrimps are also presented.

Introduction
Prawns and shrimps belonging to the swimming group of Decapod crustaceans in the suborders Nan-tantia:

- are characterized by having a body more laterally compressed;
- have well developed pleopods and 1st abdominal pleuron;
- often have a narrow thoracic sternum; and
- have a telson tapering distally.

They are subdivided into 4 major groups, Sergestoidea, Penaeoidea, Stenopodidea and Caridea.

Fewer than 300 species of prawn and shrimp are of economic interest worldwide (Chan 1998). Most commercial prawns and shrimps belong to Penaeoidea.

The Thanlwin River mouth lies in the north-central part of the Gulf of Martaban (Mottama), between 15° and 16°30’ N and 97° 21’ to 97° 36’ E. It is surrounded by the Taungnyo Range to the east, Bilugyun Island to the west and the Gulf of Martaban and the confluence of three rivers, the Thanlwin, the Gyaing and the Ataran River to the south. There are also a number of smaller rivers discharging a freshwater load into the Gulf of Martaban.

Along the coastline are shrub vegetation and mangroves which serve as natural habitats and nursery grounds for prawn and shrimp species. The annual heavy rainfall and these river systems cause the formation of freshwater flooded fisheries. So the study area provides valuable prawn and shrimp resources.


The present study lists species of prawn and shrimp and records the fishery status of commercial species.
The objectives of this study are
1) to record prawn and shrimp fauna abundant in the Thanlwin River mouth and adjacent waters,
2) to determine the distribution ranges of each species, and
3) to assess the fishery status of commercial prawns and shrimps.

Materials and Methods:
All the specimens of prawns and shrimps were
• collected from various types of fishing devices after October 2008,
• photographed,
• preserved in 10% formaldehyde-seawater,
• stored in separate bottles,
• deposited at the Department of Marine Science, Mawlamyine University (MMB), Mawlamyine.

   Key characteristics, petasma, thelycum and appendix masculina of each species were examined under the binocular microscope.


Study of inshore bag net fishery:
Samples were collected monthly from Kyaikkhami, Setse and bimonthly from Ahlat, sorted and weighed by category. Total catch weight of prawns and shrimps per boat was recorded.

Study of inland freshwater fishery:
The assessment of total catch weight of Macrobrachium species was recorded daily from commercial landings at Dawland (area I), Chungnakwa (area II), Mawlamyine (area III), and Kalwi (area IV), from July 2009.

   On each sampling day, one basket (about 16 kg or 10 viss) of a weekly sub-sample was taken, sorted and weighed by category.

   Based on the samples, the average catch rates of each category were estimated by multiplying the values obtained by the total number of baskets landed per day (kg/day). The average production from the four commercial landings was recorded.

Status of prawn and shrimp fisheries in the Thanlwin River mouth and adjacent waters.
Prawn and shrimp communities exist in three habitats in the Thanlwin River mouth and adjacent waters:
1) brackish water;
2) upper area or freshwater; and
3) middle or gradient areas.

The fisheries were presented into two parts:
• inshore fishery in the Thanlwin River mouth
• fishery in the Thanlwin River and its tributaries involving freshwater prawns, Macrobrachium species.
Trends in Commercial Fishery in the Thanlwin River mouth

Prawn and shrimp fishery in the brackish area of Thanlwin River mouth uses bag nets as the principal fishing gear.

Fishing activities are generally conducted throughout the year except in severe weather conditions. In Kyaikkhami and Setse, the operational area is 6-10 miles from the shore and at a depth of 10-30 m facing of the tidal flow. Fishing is conducted from the 5th to 14th days of the lunar month with 3 to 4 catches per day. In Ahlat region, fishing is conducted between the coastal mud flat and sub tidal flushing throughout the month.

From shrimp catches by bag net, nine species plus various fish and small crabs were collected:

1) *Metapenaeus brevicornis*  
2) *M. tenuipes*  
3) *Parapenaeopsis sculpitis*  
4) *Penaeus canaliculatus*  
5) *Solenocera crassicornis*  
6) *Acetes indicus*  
7) *Exhippolysmata ensirostris*  
8) *Exopalaemon styliferus*  
9) *Nematopalaemon tenuipes*

All prawn and shrimp species are of minor economic importance.

Production through capture fisheries

It was found that *P. sculptilis* and *E. styliferus* were consistently present in all seasons, and *A. indicus, E. ensirostris* and *N. tenuipes*, small in size, form the bulk of fishery.
Monthly catch rates were high in March-May and low in September-December. The catch rates at Kyaikkami were about 1.5-2.0 times greater than at Setse. The greatest catch rate was found at Kyaikkami followed by Setse and Ahlat.

Trends in Commercial Fisheries of *Macrobrachium* species

The upper (freshwater) and middle gradient areas of the Thanlwin River mouth are well known as productive areas for wild stock of several species of *Macrobrachium*.

Four productive areas in the Thanlwin River were selected:
- Area I: upper freshwater region in Kayin State
- Area II: upper freshwater region in Mon State
- Area III: the middle or gradient region at the confluence of the Thanlwin and Gyaing rivers
- Area IV: the coastal creeks on Bilugyun Island.

Fishing activities generally start in mid-June in all fishing areas. Artisanal fishery and various indigenous methods are used. The principal fishing gears used in the study area are shown in picture a to j. They are used in freshwater: (rivers, lakes, ponds, ditches, canals, and depressions, especially perennial and inundated flood plains), brackish water, backwaters and river mouths. Fishermen use a wide range of fishing gears and methods according to region and season.

A total of seventeen species of *Macrobrachium* were found in commercial catches. Among them, *M. rosenbergii* and *M. villosimanus* were predominated. The catch composition of *Macrobranchium* species varied depending on season and area.

The most abundant prawn species was *Macrobrachium rosenbergii* which constituted 54% of the total prawn catch at Chungnakwa, 67.5% at Dawland, 78% at Mawlamyine and 74% at Kalwi. It is one of the most important species and provides profitable fishery.

Production through *Macrobrachium rosenbergii* capture fisheries

In the post monsoon period (October to January), *M. rosenbergii* was abundant in all landings. The maximum catch rate was found from October to November. From February onwards the catch rate gradually dwindled. The best landing site was Dawland followed by Chungnakwa, Mawlamyine and Kalwi. The production rate in 2010-2011 was lower (about two times) than in 2009-2010 at Dawland and Chungnakwa landings (Fig.43)

Conclusions:

The Thanlwin River mouth and adjacent waters are rich in freshwater and brackish water prawn and shrimp species. This area is a distinctive for its inland and inshore prawn and shrimp fisheries. These resources provide not only for local consumption but also for foreign earnings. Prawn and shrimp fisheries in brackish water in the Thanlwin River mouth use not only passive gears but also traditional methods.

Lin Lin Htike (2008) pointed out that the biomass of *P. sculptilis* should be increased by 10% for maximum sustainable yield in Setse.

Observations indicate that *M. rosenbergii* stock has apparently decreased from year after year in the study areas because of extended fishing, ecological changes in their habitat caused by various human impacts, environmental conditions, climatic change, and agrochemicals and pesticides used in cultivation.

Although prawn and shrimp resources have been exploited for many years, biological and fishery research in the study area is fragmented. It is suggested that further biological investigations using a predictive model be carried out on the population structure of prawn and shrimp in the Thanlwin River mouth and adjacent waters and measures for the long term conservation and management of this valuable natural resource.

The most important factor in the management of fishery resources and ecosystems is a good understanding of the socio-economic condition of the fishers. A lack of education and poverty are the chief factors. Therefore, basic knowledge of the environmental factors related to the fishing and the impact of fishing gear on the environment and fisheries should be provided. Fishers should cooperate in adopting short closure periods to ensure sustainable management. Instead of exploiting wild prawn and shrimp resources, intensive prawn and shrimp culture should be developed locally and regionally.
Mid-Salween development plans and ecological/hydrological implications: Lessons learned from the Mekong River

Mr. Montree Chantawong
Towards Ecological Recovery and Regional Alliance (TERRA)

A. Lessons learned from the Mekong River
There are a number of hydropower projects on the mainstream Mekong River. 6 dams have already been built on the Mekong (Lancang) River in China over the past 20 years: Manwan in 1996, Dachaoshan in 2003, Jinghong in 2008, Xiaowan in 2010, Gongguoqiao in 2011, and Nuozhadu in 2012.

The original plan for Lower Mekong mainstream hydropower was developed in 1970 by the Mekong Committee and proposed again in 1994. 12 dams are planned for the Lower Mekong, but only Xayaburi Dam is now under construction supported by Lao PDR. The 12 proposed dams are:

- 8 in Lao PDR: Pak Bank, Luang Prabang, Xayaburi, Pak Lay, Sanakham, Lat Sua, Don Sahong and Thakho
- 2 on the Thai-Lao border: Pak Chom and Ban Koum
- 2 in Cambodia: Stung Treng and Sambor

Total installed capacity of these 12 dams (if all are built) is 14,697 megawatts (MW) and most of electricity produced will be sold to Thailand and Vietnam.

Normally, the average flow from China contributes 16% to the Mekong Delta in Vietnam while at the MRC’s Gauge Station in Chiang Saen District, Chiang Rai Province in Northern Thailand (around 850 kilometres from Manwan Dam to the Golden Triangle where Mekong River enters Thailand), the proportion of the Mekong flow from China is 90% plus 10% from Myanmar.

Since the opening of Manwan dam in 1996, downstream area has been affected by many impacts.

1. Decrease in sediment

According to the SEA Report of the MRC in 2010, the Mekong River normally carries around 160-165 million tonnes per year, 50% of which is now blocked by the Chinese dams. If the 12 proposed dams on the lower Mekong River are built, sediment will decrease by around 50%. For example, if the Sambor dam is built in Cambodia, sediment will decrease by up to 25% compared to the present.

2. Unnatural water level fluctuations

Two graphics below show the different water level fluctuations of the Mekong River during the dry season (from January to March) before (1983-1992) and after (1993-2010) the Manwan dam was built. It appears that, before the Manwan dam, the situation was natural/normal while the data after the dam was built shows high fluctuations (this baseline data was provided by Mekong River Commission based on hourly measuring at their gauge stations). In Thailand, the Mekong water level can be checked and monitored from the water gauge station in Chiang Saen District.
The unnatural water level fluctuations affect river bank agriculture as well as other creatures living on sand beaches during the dry season. For example, when the water rises, birds’ eggs laid under plants growing on the bank are flooded.

3. **Drought and flood**

The graph below (developed by the Water Resource Department of Thailand) shows that after the Manwan dam began to store water in 1993, the average minimum flow decreased to 569 m³ compared to the average between 1962 and 1992 which was 752 m³. Communities along the Mekong River in Northern Laos and Northern Thailand consequently suffered unprecedented floods and droughts coinciding with the impounding and discharge of water from upstream dams in China located hundreds of kilometres away to the north.

![Graph showing change to Mekong flow](image)

The drought frequently occurs downstream on the Mekong River. In some years, boats from Thailand could not get to China and had to stop at Chiang Saen Port.

In 2010, Mr. Ya Wen, a representative of China’s Ministry of Foreign Affairs, admitted for the first time during a seminar in Bangkok that the Xiaowan dam had started impounding in July 2009 and stopped with the onset of the dry season. He also said that from 1 December 2009 to 11 March 2010, the water released from this hydropower station exceeded the water received in order to elevate dry season water levels downstream.

According to a Mekong River Commission (MRC) Report, the low water levels in downstream countries were caused by drought.

On the other hand, the Mekong unexpectedly flooded Chiang Khong in August 2008, and local people believe that this flood was caused by China releasing water from its dam reservoirs after a period of heavy rain.

4. **Bank erosion**

Riverbank erosion has occurred along the Mekong River on both the Thai and Lao PDR sides. For example, during the rainy season, riverbanks that had been stable for decades began to collapse into the Mekong River in Chiang Khong District, Chiang Rai Province. The local people have noticed increasing erosion and under-cutting of riverbanks. In the village of Pak Ing Tai village, Chiang Khong District, Chiang Rai Province, one hectare of land was lost to erosion in this way. Three neighbouring villages lost a total of nine hectares of land, and one family’s house was destroyed.

On the Lao side of the river, Don Sawan village (113 households) in Tonpheung District, Bokeo Province, had to move to a new location, as severe erosion threatened to destroy their houses.

5. **Decrease in fish**

In Chiang Saen and Chiang Khong districts in northern Thailand, downstream of China’s Mekong dams, local people state that more than 60% of fish stocks have declined due to the unusual flow and fluctuation of the Mekong River.

6. **Other ecological impacts**

In several communities along the Mekong River in northern Thailand, local people collect the freshwater weed, *kai*, which is an important source of food and protein, as well as of income. The production of *kai* is dependent on the seasonal flow of the Mekong River as *kai* grows on rocks and rapids during the dry season when the water is receding and clear. For the past several years, the local people have reported that the water fluctuations have affected their rich resource and resulted in a decrease in *kai* production.
B. Strategic Environmental Assessment (SEA) of Hydropower on the Mekong Mainstream

According to the Strategic Environmental Assessment (SEA) of Hydropower on the Mekong Mainstream (http://www.mrcmekong.org/assets/Publications/Consultations/SEA-Hydropower/SEA-Main-Final-Report.pdf) prepared for the Mekong River Commission (MRC) by the International Centre for Environmental Management (ICEM) and released in October 2010, the potential transboundary and cumulative impacts from lower Mekong mainstream hydropower dams are as follows:

1. Lower Mekong mainstream dam projects would convert 55% of the Lower Mekong River into reservoirs with the potential to induce significant and rapid fluctuations in downstream water surface levels at a daily and even hourly time-step.
2. There is the potential for hourly spikes in water level of up to 3-6m at towns and villages located 40-50 km downstream. Under unplanned and emergency release, peaking events could be larger and could travel that distance downstream in 1-2 hours giving little time for notification.
3. Fish yields in the Mekong, at least 35% of which comprise long-distance migrant species which would be barred by dams, would be undermined in abundance, productivity and diversity. And at least 41 out of 262 mainstream species in the ecological zone upstream of Vientiane are threatened by a severe alteration of their habitat.
4. The sediment load of the river would be reduced, despite the fact that river’s nutrient load is critically important to ecosystem vitality along the its length, including in the Tonle Sap area and Mekong Delta which are hotspots for fisheries as well as agriculture.
5. The livelihoods of at least 2.1 million people would be directly or indirectly affected, by wiping out riverbank cultivation, agricultural land and housing areas and decimating the river’s wild-capture fisheries.
6. Poverty in the region would be exacerbated. The SEA study of MRC also stated that any economic benefits from the dams is likely to be unevenly distributed, with most being concentrated among investors and governments whereas most of the costs would be borne by poor and vulnerable riparian communities.

C. Hydropower projects on the Thanlwin/Salween River in Myanmar

There are 7 proposed hydropower projects on Thanlwin/Salween River as shown in the following list in which Hat Gyi Dam is included:

1. Kunlong Dam: 1,400 MW (Hanergy Holding Group Company, Gold Water Resources Company)
2. Nong Pha Dam: 1,000 MW (Hanergy Holding Group Company, Gold Water Resources Company)
3. Ta Sang/Mine Ton Dam: 7,110 MW (EGAT Inter. – China Three Gorges Corporation – IGOEC/IGE)
4. Ywathit Dam: 4,500 MW (China Datang Overseas Investment Company)
5. Weigyi Dam: 4,540 MW (EGAT)
6. Dagwin Dam: 790 MW (EGAT)
7. Hat Gyi Dam: 1,360 MW (EGAT Inter. – Sinohydro Corporation Company – IGOEC/IGE), this dam will inundate up to 700 km²

Total installed capacity of these 7 dams is 20,700 MW and most of electricity generated will be sold to Thailand and China.

It is not certain whether the figures are the same within Myanmar, but the latest status of Hat Gyi Dam’s shareholders in Thailand as revealed in 2010 shows that Sinohydro Corporation Co. Ltd holds 50.5% of the shares, EGAT Inter Co. Ltd. 36.5%, DHPP of Myanmar 10% and International Group of Entrepreneurs Co. Ltd. (IGOEC, Myanmar) 3% respectively. The total investment cost of the Hat Gyi dam is US$2,600 million.

EGAT hired the Environmental Research Institute of Chulalongkorn University to conduct the Environmental Impact Assessment (EIA) of the Hat Gyi Dam in the relevant areas. The EIA report stated that 110 households in 6 villages will be moved out of the reservoir location.
Many aspects of the Hat Gyi Dam relate to Thailand. Firstly, this dam will generate 1,360 MW of electricity of which 1,300 MW will be exported to Thailand while 60 MW will be domestically used. Secondly, according to the latest Memorandum of Agreement signed in April 2010, the reservoir contour line upstream of the Thanlwin/Salween River shows that not only the Myanmar side but also Thai side will be inundated: the impact of this dam is therefore a cross-border impact. Many Thai groups asked EGAT to conduct a transboundary impact assessment, but EGAT has responded that it is unnecessary and continues to insist that there will be no inundation of Thai territory.

With respect to downstream impacts of the Hat Gyi Dam, the EIA report revealed that from November to June each year, the average flow will be between 800 and 5,200 m³. The dam in question will close its gates daily from 9 pm to 5 am but still release 500 m³ downstream. The main concerns regarding the impacts of unusual fluctuations on downstream areas and other potential risks are as follows:

1. Hydrological change: The daily operation of the dam, withholding water for 8 hours and then releasing water for 16 hours to generate power during demand periods will affect the natural river flow as well as the river’s interaction with tides at the mouth of the river.

   The graph below from the EIA study shows the maximum change in water level in 1 hour at the minimum inflow year (1986). The highest fluctuation was 3 metres per hour at Meseik while the lowest was 0.75 metres per hour at Hpa-an. However, there is no information available about changes in river flows and other downstream impacts at the mouth of the Salween River in Mawlamyine even though it is only 120 kilometres from the Hat Gyi dam.

2. Riverbank erosion: Water released from the dam will alter the timing of the flows. Unusual and rapid changes in the water flow will create sudden strong surges that erode soil, vegetation and riverbanks, significantly affecting downstream stretches. The EIA also mentioned three sections of the Thanlwin/Salween River where the riverbank will be affected by the operation of the Hat Gyi dam, indicate by the red lines in the pictures below.
3. Impacts on river ecosystems and fisheries. The irregular releases of the water from the dam will destroy natural seasonal flow, the life cycles of aquatic species and ecosystem integrity. Fish migration will be blocked by the dam and fish spawning grounds and habitats will also be affected.

4. Impact on the food security of local people. Loss of fisheries will undermine the abundance, productivity and diversity of fishery resources and will affect local people who rely on this for nutrition and livelihoods.

5. Seismic risk. The site of the Hat Gyi dam is located on the Si Sawat fault line and poses a significant risk of potentially disastrous consequences.

The Mekong River and Salween rivers are international rivers. While the Mekong is one of the few remaining international rivers undammed over most of its length; Salween is the only remaining major free-flowing river in Southeast Asia. The past decade of hydropower development in the upper Mekong River in China has raised concerns over the environmental and social impacts to downstream communities. Furthermore, the recent SEA study on the proposed lower Mekong mainstream dams also illustrates several serious risks especially on the fisheries and agriculture on which local people rely.

The 7 proposed hydropower projects on the Thanlwin/Salween River importantly require, apart from the EIA/SIA/HIA for each dam, an SEA on the Thanlwin/Salween River in order to assess all accumulative impacts before any decisions on hydropower development are made.
In 1992, the Asian Development Bank (ADB) initiated the Greater Mekong Sub-region (GMS) program for the economic regionalization and integration of mainland Southeast Asia, including parts of southern China. The ADB’s GMS program advocated a number of regional development projects, one being the construction of regional energy infrastructure based on conventional forms of energy generation, including large-scale hydropower dams and coal-fired power plants.

The ADB has completed a country-by-country survey of the energy resources in mainland Southeast Asia. The ADB views the region’s natural assets as resources that can be converted to electricity by way of more conventional technology, such as hydropower, coal-fired power plants, gas or oil. However, the survey includes no information on renewable energy.

The ADB’s main underlying drive and assumption is this: how can they improve the flow of the region’s energy resources? For the ADB, the way forward is to create a regional energy market and improve the transportation infrastructure to function as its transmission system. Thus the ADB proposed the GMS regional grid, which aims to connect areas with high investment potential for energy generation (from dams or other means) and bring the electricity to areas of demand.

Today, most of the population in China, Vietnam, and Thailand are connected to their national grids, with electrification rates of 95-99%. However, Cambodia and Myanmar have electrification rates of less than 30%, and generally, their national grids are developed only in the central and more populated parts of the country. However, this does not mean that populations living outside of the national grid system (or what is called “off-grid”) are left in the dark, as people have other means of generating electricity for their own use.

Given Myanmar’s electrification rate of 23-26%, if we look at the assumptions made by the ADB, it should be clear where the electricity should go – back to Myanmar. However, contrary to this logic, the ADB has brought the electricity instead to the markets of Thailand, China and Vietnam, rather than to the countries that still lack electricity.
Myanmar’s Power Sector

Myanmar’s peak electricity demand (as of 2010) is 1,533 megawatts (MW), and of total electricity consumption, the majority of users (46%) are households, while industry takes 36%, and commercial users 20%. This is very different from Thailand’s consumption pattern, where the majority users are industry with 49% of the total, commercial users with 25%, and just 21% going to household use.

With respect to urban energy consumption in Myanmar, 45% of the electricity generated is used in Yangon and 16% in Mandalay. This indicates that the electricity generated goes mostly towards consumers in the big cities, which is why the lion’s share is taken by Yangon.

In Myanmar, electricity prices vary depending on the buyer, where prices for households are the lowest, in contrast to Thailand, where industry pays the lowest prices.

Myanmar’s current electricity needs are at 1,500 MW. However, the country has an installed capacity of 3,600 MW, more than double its peak demand. Of the total percentage of electricity generated in Myanmar, the majority, 77%, comes from hydropower, with 20% from gas, and 3% from coal.

The question is, since Myanmar has an installed capacity of double its peak demand, why does the country still experience blackouts in some seasons? This is not due to a lack of installed capacity. Rather, it is because this 3,600 MW might not be functioning well enough to serve the 1,500 MW of demand. So Myanmar must look at how to improve the use of its installed capacity.

Almost every village in Myanmar employs a form of off-grid generation, such as diesel or mini-hydro projects run by local entrepreneurs. For example, the country has over 10,000 diesel plants operating and nearly 6,000 mini-hydro projects of less than 1 MW capacity. So apart from the 23% electrification rate, which indicates only the number of people connected to the national grid, the rest of the people have their own systems. There are many other ways to improve these off-grid systems.

There is an interesting case in the Ayeyarwady (Irrawaddy) Delta, visited by the MEE Net team. Local people there use diesel engines to generate electricity. They burn rice husks to obtain gas, and then use that gas to operate diesel engines. This technology has been used since WWII, though in Thailand now, only diesel is used to run engines. This method is appropriate, as people use locally-sourced biomass to run the engines, and they have a comparatively well-functioning system of distribution lines, especially within the context of self-reliance and the lack of government support. However, local people should receive institutional support such as access to cheaper financial sources and clear regulations for license approval.

The national grid in Myanmar covers 23-26% of the country, and plans for future grid expansion are quite ambitious. The big question is: how much money does Myanmar have to spend on this?

In Thailand, major national grid expansion took place during the Cold War era. At that time, there were several types of loans, such as those offered by the World Bank, which provided finance for transmission line investment. But at present, these financing options are not available. Therefore, investment must rely mainly on private lending, which is quite difficult to secure. Who will provide funding, and how many millions of dollars are needed? And how long will the people of Myanmar have to wait until the transmission lines reach them, which in some cases may be as long as 20, 30, or even 100 years? However, if Myanmar focuses on developing a decentralized system, electricity could reach people sooner, without the need to wait for national grid expansion.
In Myanmar, there are several hydropower project investments generating electricity mainly for export. For example, electricity from the Salween River dams will mainly go to Thailand, electricity generated from the Ayeyarwady River dams will go to China, and electricity from the Tamanthi Dam on the Chindwin River will go to India – altogether about 31,000 MW. So with all of these resources developed, the electricity will not serve Myanmar’s domestic needs but will be transmitted elsewhere. Myanmar has a peak demand of only 1,500MW, and these hydropower project investments will generate in total 20 times what Myanmar actually needs.

To bring electricity to Thailand and China, Myanmar must build a large-scale transmission system. But whatever Myanmar invests in its transmission system will become part of the national debt, rather than the project owners’, simply because it will be part of the country’s national grid. There is always some difficulty in identifying which projects will develop the national grid and which are for Independent Power Producer (IPP) export. Many World Bank and ADB projects in the region fall under the title of “rural electrification” but are actually going towards transmission investment. So the end benefit would not be for the rural people, but for IPPs instead.

A transmission system can be likened to a road. Normally, all of these electricity projects require 500 KV transmission lines, which are like superhighway roads, from Yangon to Naypyidaw. But actually, the transmission lines that connect one province to another might require only small roads, rather than a superhighway. Or linkages between villages may need smaller streets which are suitable for bicycles or motorcycles, not for big trucks.

In Thailand, for example, in EGAT’s 2013 budget, 200 billion baht is dedicated to transmission investment, making up more than 40% of the total budget. Although the existing EGAT transmission system is secure, EGAT still continues investing in ever greater networks of transmission lines. And we can see the benefits of this investment going to large-scale consumers like industry because 500 KV transmission lines are not for rural or household use.
Organization and Function in Myanmar’s Power Sector

Until September 2012, the power sector in Myanmar was the responsibility of two separate ministries, the Ministry of Electric Power 1 (MOEP1) and Ministry of Electric Power 2 (MOEP2). Following this, these two ministries were merged into one – the Ministry of Electric Power (MOEP). The organization and functions of MOEP are provided below:

In 2012, ADB outlined future power development in Myanmar, mentioning 92 large-scale (>10 MW) hydropower sites in Myanmar’s main river basins with an estimated total installed capacity of 46,000 MW. Currently, the Hydropower Generation Enterprise (HPGE) operates 17 hydropower plants with a total capacity of 2,010 MW. The MOEP is planning to build another 13 hydropower plants in the period to 2020, with a total capacity of 2,572 MW. Local enterprises will develop 7 hydropower plants, with a projected combined capacity of 500 MW. And a further 44 projects are planned as joint ventures with foreign investors, totalling an additional 42,146 MW.

The structure of the whole power sector is divided into four parts, like such:

Generation ➞ Transmission ➞ Distribution ➞ End User

It is important to know which agencies are working on which part and which agencies dominate during the project proposal or planning processes, and try to seek areas for potential improvement.

For example, the Electricity Supply Enterprise (ESE), the agency in charge of electricity distribution in Myanmar, is responsible for the off-grid system and has many important tasks. Therefore, how can ESE be strengthened? Otherwise, the agencies that oversee generation involving joint ventures and IPPs would dominate and push for large project investment. If we look carefully at the structural level, we can see how and where reforms can be made.

In my view, there are three different frameworks currently operating in Myanmar’s power sector:

1) National grid: This covers 23-26% of the country and has been developed through the centralization of the national grid.

2) Off-grid: Thousands of decentralized isolated mini-grids are operated by local entrepreneurs, but most people remain without electricity.

3) IPP for export: About 46,000 MW of electricity from hydropower projects has been targeted for export.

How can Myanmar deal with the complex realities contained within these three systems? In my opinion, there are two paths for the future development of Myanmar’s power sector:

1) Centralized option: The centralized national grid will be connected to the regional grid, which is built across country borders. Electricity will be distributed mainly to areas with paying consumers, rather than areas with undeveloped markets. This is the current trend.

2) Mixed or open system option: Targets and objectives for each of the three different systems (the national grid, off-grid, and IPP for export systems) can be set using different but complementary development frameworks. This means that these three systems can co-exist in a way that gives equal or greater priority to those with less economic or political power.

What kind of framework is appropriate for each area? Each system is built upon a different framework and values. The national grid is part of the country’s infrastructure, which is linked to issues of national security, the economy and welfare. The off-grid system provides for people who are unable to access the national grid, but who also need electricity to improve their lives, such as by allowing them to work or read at night – tasks which can be considered basic human rights.

Finally, the stated rationale behind implementing IPP projects for electricity export is the additional revenue generation for the country, which provides capital that can assist in developing other parts of the power sector. If this is truly the goal, how can one ensure that the money from IPP projects will go directly to developing the national grid and off-grid systems?

Additionally, IPPs utilize and exploit the country’s natural resources, especially those resources that people in the off-grid systems rely upon, and their livelihoods will be sacrificed for IPPs to produce electricity as an export commodity. But for whom are Myanmar’s IPP projects actually being produced? Why are the people of Myanmar being asked to sacrifice their lives and resources for Thailand’s industry or any other country’s electricity demand?

Furthermore, how can we develop institutional arrangements for the equitable and just development of the power sector? If we collapse these three different systems into one unified Power Development Plan (PDP), then the stronger systems in terms of political and economic power and interests will dominate, while weaker voices will be faded out.

However, if a separate PDP is developed for each system, then these three systems will be able to complement and coordinate among each other. Then one might have to consider what organization or agency can oversee this process.
If the rationale of the IPP system is to generate revenue to develop the national grid and off-grid systems, a clear mechanism to channel the money for this development is necessary. From what I see in Myanmar, the distribution of the off-grid system is weak, and distribution lines are too costly for local entrepreneurs. That is why the price of electricity in the village is very high, sometimes up to 600-700 kyat per unit, as local entrepreneurs have to invest a great deal on the transmission or distribution systems, which are themselves weak. When the system is weak, up to over half of the electricity generated is lost.

So the alternative would be for the government to invest in distribution systems wherever mini-grids exist, which will then belong to the government rather than to local entrepreneurs. And when the national grid is developed to reach these areas, the grids can just be connected, without building additional distribution line systems. This is a way to support and improve the off-grid system while still allowing for the development of the national grid. Even in Yangon, there should be no reason for brownouts or blackouts in the city if the distribution system is improved, as this problem does not come from the lack of capacity, but rather the failure of IPPs to pursue improvements.

Also, there are many concrete issues that we can think about in terms of how Myanmar can solve the problem of blackouts in the summer. In terms of gas, Myanmar is gas-exporting country. Yet Myanmar only has a few gas turbine generators and no gas to run them.

The gas needed is actually only a very small amount. Compared to Thailand, which imports gas from Myanmar at the rate of about 1,100 million cubic feet a day, the Myanmar gas turbines might need less than 50 million cubic feet a day.

Yet some might still counter that since Myanmar and Thailand are neighboring countries, since Thailand needs electricity and since investments can generate revenue for Myanmar, the Myanmar people might be happy to export electricity to Thailand. The truth, as we have seen, is more complex.

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**Thailand’s Power Development Plan: Over-Forecast & Over Investment**

Let’s look at Thailand’s electricity demand and see how the system is working. Thailand’s future energy demand forecast predicts electricity demand and consumption for the next 15 or 20 years, usually based on GDP figures. But the problem is that while GDP may grow in the span of 1 or 2 years, the electricity demand forecast attempts to generalize that data over the next 15 years. Since 1993 future energy demand projections in Thailand have consistently over-forecast demand. And this is sure to occur in Myanmar too.

At this stage, Myanmar still needs to increase its electrification rate, bring electricity to the people, and focus on investing in the transmission system. But when the target of making electricity accessible for everyone has been reached, another problem may be encountered, which is the over-projection of energy needs that leads to over-investment and the creation of non-performing assets in the system.

According to the Thai government’s PDP 2030, which projects 20 years in the future, Thailand’s installed energy capacity will be up to 60,000MW, which is very high. This figure is based on the government’s assumption that each year Thailand’s average annual energy growth will be 1,400MW.

However, instead of using the government’s assumption, we have come up with an “Alternative PDP,” which looks at the actual annual average increase over the past 25 years, which is only 380 MW.

Thus each year we can reduce 660 MW from the forecast growth, which in 20 years adds up to about 12,000 MW, or nearly 10 times Myanmar’s peak demand. So we can reduce the figure from 60,000 MW to roughly 40,000MW.

Furthermore, the policy of the Thai government is to promote energy efficiency and renewable energy to account for 25% of the total energy supply or generation. From research, 30% of potential capacity can be saved from energy efficiency. So if we focus on energy efficiency measures and renewable energy, there is no need to build big dams, coal-fired power plants or nuclear plants in the next 15 years. Thus Thailand can cut one trillion baht of investment capital by following the alternative plan.

But the problem is that the Thai government wants the country to be a “hub of energy.” They want to create an energy market and position Thailand as the centre in the region. They are not concerned with where and for whom the energy is generated. That is why Thailand’s power development plan has shifted its focus to the creation of the energy industry and energy business, rather than looking at the energy security of the country.

But who will gain, and who will lose? For example, three big shopping malls in Bangkok together consume about 278 million units of energy per year, comparable to the output of three dams in the northeast, namely the Pak Mun, Sirindhorn and Ubonrat Dams, which produce 266 million units per year. It’s clear that these three dams cannot feed these three shopping malls. But looking solely at Pak Mun Dam on the Mun River, a main tributary of the Mekong River, research and evaluations have assessed that the fishery yield has decreased by 80%, 116 fish species have been lost, 1,700 families have been relocated and 6,200 families have lost their livelihoods. This is the trade-off for these communities. Yet who is using most of the electricity? And furthermore, these three shopping malls can do much more in energy efficiency.
Yangon – Environmental expats from Myanmar, Thailand and China said their governments should coordinate studies of the socioeconomic impact and environmental damage due to the construction of dams along the river crossing the three countries.

This was said during the workshop ‘Values of Salween River’ held on May 28.

Thirteen dams will be built on the Salween River in China and six in Myanmar with an estimated installed capacity of one and a half thousand megawatts involving five Chinese companies, two Myanmar companies and one Thai company.

“Development projects in the river basin, especially hydro power projects, should be coordinated among the countries. Projects should not be done without coordination,” said Professor U Maung Maung Aye from the Myanmar Environment Institute.

The Salween River has not yet seen an institute like the Mekong River Commission to coordinate among countries.

Expats say the Chinese government should take responsibility for the environmental and socio-economical impact on downstream countries like Myanmar from the construction of 13 upstream dams on the Salween River.

“If these 13 dams are built blocking the flow of the Salween River, we people in Myanmar as a downstream country face the impact. That’s why we need to discuss it with China. We need to do a transboundary assessment.” U Myo Maung, an environmental expat, said.

Companies working on dam projects in Myanmar must also respect the laws of the country on natural resources and the environment, said U Thein Lwin, Secretary of the Natural Resources and Environmental Conservation Committee.

Dams blocking the river flow can cause negative consequences: deforestation, climate change, changes in the course of the river, extinction of biodiversity, reduced sedimentation in river basin and on land, flooding, health problems, and social and cultural insecurity due to migration, stated the Burma River Network.

Though Myanmar has issued laws on the conservation of natural resources and the environment, there are as yet no rules and regulations to implement the law. The Salween is one of the longest rivers in the world and has been listed as a river without dams until 2013 on the list of UNESCO’s World Heritage sites.

The Salween River crosses Yunnan province in China, Shan, Kayah, Kayin and Mon states in Myanmar and empties into the Andaman Sea. It forms the border between Thailand and Myanmar in Kayin State.
Environmental scholars from Myanmar, Thai and China study Salween River basin

Sunday, 02 June 2013

In order to study the possible impact of hydropower dam construction on the socio-economic and ecological systems on the Salween River, a group of environmental scholars from Thailand, China and Myanmar made a field study trip around Mawlamyine, Bilugyun (Chaungzon), and the delta area of the Salween, Gyaing and Ataran on May 31.

The group met residents of Kawmupon village, explained the possible impact on the socio-economic and environmental systems and discussed these issues with the villagers.

The scholars explained the impacts of building dams upstream on the Salween River, blocking its flow, and the changes in fresh water resources.

“We learnt from the newspapers that dams will be constructed of in Myinegingu area. But we don’t know why they would be built and what they are for. We grow paddy in the rainy season and other crops in winter. We really fear that our paddy fields would be flooded by salt water. Our livelihood would be damaged if the salt water came into our plantation fields. There are also fewer fish caught.” U SoeTint from the local community expressed his concerns.

The team studied in Daye River which is a part of Salween River basin and as well as the area where the Salween, Gyaing and Ataran join.

Comment by a reader; they might come to see how many more dams could be built in the area.

Workshop on preserving ecological systems in regard to Salween river basin development projects

A workshop aiming to preserve ecological systems in regard to Salween river basin development projects was held on May 28 and 29 in Yangon at the UNFCCI building.

“Natural resources gained from the river system are important. That’s why we have organized a workshop like this in order to get scientific data and information” said U Aung Myint from REAM.

“The lifestyle of local people and the environmental situation need to be taken into consideration when development projects in the Salween River basin start. No matter where the development projects are, government institutes, businessmen and companies carrying out the projects should consider the damage to the environment and socio-economic life of peoples. Moreover they need to be transparent and respect the suggestions of the local people in order to minimize the errors and weaknesses.” said Professor U Maung Maung Aye, who presented a paper on socioeconomic studies.

MOUs were signed between 2005 and 2011 to build six hydropower projects (Kunlon, Noung Hpa, Man Taung, Mine Ton, Ywa Thit and Hat Gyi), according to an article presented by U Saw Moe Myint, a retired official from the Ministry of Mining.

The workshop was held for the first time in Myanmar. The Salween River is shared by China (53%) Myanmar (42%) and Thailand (5%).
Salween River Commission is needed, environmental expats urge

Khine Khine Soe, 31 May 2013, Yangon

A Salween River Commission is needed to do systematic research on the risks of extinction of rich biodiversity if dams are built on the Salween River, environmental expats say.

13 dams are planned along the Thanlwin River in China, with another six in Myanmar to be built by five Chinese companies, two Myanmar companies and one Thai company with a total installed capacity of over one and a half thousand megawatts.

Professor U Maung Maung Aye said a Salween River Commission should be formed like the Mekong River Commission in order to do systematic research on rare species and biodiversity along the river that risk extinction from the construction of dams.

“It’s necessary to study its ecological systems because some species can only be found in the Salween River. So far studies have been done in only a few places. There are still many places left to study” said U Nyo Maung, an environmental conservation expat.

Studies on changes in the course of the Salween River would be conducted jointly by TERRA (Toward Ecological Recovery and Regional Alliance) and MEE Net (Mekong Ecological and Energy Network).

There is heavy timber production along the Salween and about 47 rare fish species can be found only in the Salween.
# List of participants

**Regional Conference on**

**Value of the Thanlwin/ Salween River:**

**Ecosystem Resource Conservation and Management**

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<thead>
<tr>
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<th>DESCRIPTION</th>
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## Renewable Energy Association Myanmar (REAM)

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<td>Daw Theingi</td>
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## LOCAL NGO REPRESENTATIVES

<table>
<thead>
<tr>
<th>Name</th>
<th>Organization/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dr. Saw Mon Theint</td>
<td>Environmental Researcher, Myanmar Green Network</td>
</tr>
<tr>
<td>Daw Darli Thae Oo</td>
<td>Myanmar Green Network</td>
</tr>
<tr>
<td>U Sit Bo</td>
<td>General Secretary, FREDA</td>
</tr>
<tr>
<td>U Zaw Lun</td>
<td>BANCA</td>
</tr>
<tr>
<td>Naw Ei Ei Min</td>
<td>Spectrum</td>
</tr>
<tr>
<td>U Kyaw Thwin</td>
<td>Daw Khin Kyi Foundation</td>
</tr>
<tr>
<td>Dr. Nyan Zaw</td>
<td>Myanmar National Human Right Commission</td>
</tr>
<tr>
<td>U Win Maung</td>
<td>Marine Science Association Myanmar</td>
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<tr>
<td>U Tint Wai</td>
<td>Marine Science Association Myanmar</td>
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<tr>
<td>Daw Ye Ye Win</td>
<td>Marine Science Association Myanmar</td>
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<tr>
<td>Daw Lucy Chit</td>
<td>Marine Science Association Myanmar</td>
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<tr>
<td>Mai Thida Aye Kyaw</td>
<td>Volunteer, POINT</td>
</tr>
<tr>
<td>Naw Heldar Tun</td>
<td>Volunteer, POINT</td>
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<tr>
<td>S Kawt Ja</td>
<td>Volunteer, POINT</td>
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<tr>
<td>Pos Bandos</td>
<td>Program Officer, AFSC</td>
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<tr>
<td>U Myo Ko Ko</td>
<td>Founder, POINT</td>
</tr>
<tr>
<td>Ponan Pyri</td>
<td>Earth Rights</td>
</tr>
<tr>
<td>Name</td>
<td>Position/Outlet</td>
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</tr>
<tr>
<td>Aye Nyein Win</td>
<td>Reporter, The Myanmar Times</td>
</tr>
<tr>
<td>Nilar</td>
<td>Assistant Editor, Weekly Eleven</td>
</tr>
<tr>
<td>Naw Dah Dah</td>
<td>Reporter, The Golden Fresh Land</td>
</tr>
<tr>
<td>Kyi Nyein Thaw</td>
<td>Reporter, The Earth</td>
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<tr>
<td>Soe Min Aung</td>
<td>Reporter, The Earth</td>
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<tr>
<td>U Kyaw Win Bo</td>
<td>Press, Information</td>
</tr>
<tr>
<td>Ko Phyo</td>
<td>Reporter, News Watch</td>
</tr>
<tr>
<td>Nay Min Kha</td>
<td>Reporter, News Watch</td>
</tr>
<tr>
<td>Aye Chan Moe</td>
<td>Senior Reporter, Union Daily</td>
</tr>
<tr>
<td>Khine Khine Soe</td>
<td>Reporter, 7 Day News</td>
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<tr>
<td>Ye Naung</td>
<td>Reporter, 7 Day News</td>
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<tr>
<td>April Oo</td>
<td>Reporter, The Earth Jounal</td>
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<tr>
<td>Sandi Than Tin</td>
<td>Senior Reporter, Unity</td>
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<tr>
<td>Nyi Htwe</td>
<td>Reporter, The Light of Asia</td>
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<td>Min Chit Naing</td>
<td>Editor, The Light of Asia</td>
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<td>Reporter, The Farmer Myanmar</td>
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<td>Reporter, Maw Kun</td>
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<td>Hnin Ko</td>
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<tr>
<td>Aung Aung</td>
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<td>Eleven Media</td>
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