

Seminar Proceedings

Climate Change Adaptations in River Basins: Upstream and Downstream Linkages

5 September 2018 at Pan Pacific Sonargaon Hotel, Dhaka, Bangladesh



Consortium members



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About HI-AWARE

The Himalayan Adaptation, Water and Resilience Research (HI-AWARE) Consortium conducts research and pilot interventions, capacity building and policy engagement to enhance the climate resilience and adaptive capacity of poor and vulnerable people living in the mountains, hills and flood plains of the Indus, Upper Ganga, Gandaki and Teesta river basins in Pakistan, India, Nepal and Bangladesh.

HI-AWARE aims to influence policy and practice to aid the climate resilience and adaptation of poor and vulnerable populations in the region by generating evidence based knowledge on geophysical, socioeconomic, gender and governance drivers and conditions leading to climate vulnerability, as well as monitoring and assessing adaptation measures. It focuses on identifying 'critical moments' when communities are most vulnerable to climate risks, 'adaptation turning points' when existing adaptation strategies no longer work, and "adaptation pathways", sequences of policy actions that address both short-term responses to climate change and longer term planning. It looks at strengthening the expertise of researchers, students and science-practice-policy networks to conduct as well as use research on climate/ social vulnerabilities, resilience, and adaptation.

HI-AWARE comprises of five consortium members: The International Centre for Integrated Mountain Development (ICIMOD), the Bangladesh Centre for Advanced Studies (BCAS), Pakistan Agricultural Research Council (PARC), The Energy and Resources Institute (TERI)-India, and Wageningen Environmental Research (Alterra).

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HI-AWARE Internal Report

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Executive Statement

This seminar is the final stakeholder dissemination of HI-AWARE research in terms of policy, science and practices in the field held in Bangladesh. There will be also similar seminars in the partner countries in India, Pakistan and Nepal. The seminar was held the whole day on September 5, 2018 at the Pan Pacific Sonargaon Hotel, Dhaka, Bangladesh. The seminar was divided into six sessions: inaugural, technical, 3 panel discussions and the closing.

One important thing is to mention here. Just day before the seminar, the national level plan Bangladesh Delta Plan 2100 (BDP2100) was approved by the government of Bangladesh. BDP2100 is considered as a strategic plan for the country which considered the climate change issues and proposed 80 projects investing US\$37 billion by 2030 to achieve the sustainable development goals.

In the inaugural session, Dr. KS Murali and Dr. Philipus Wester provided a glimpse on CARIAA and HI-AWARE research respectively. Then two special guests one Mr. Peter de Vries from Netherlands Embassy and the other Prof. Shamsul Alam, Senior Member of the Planning Commission of Bangladesh shared their views on how the research outputs can be integrated in the BDP2100 and other national plans. Mr. de Vries emphasized that Netherlands government will continue help Bangladesh for implementing the BDP2100 while Prof. Alam emphasized creating a knowledge hub as per BDP2100 where different database will be generated and HI-AWARE kind of research will feed this knowledge hub a lot. The session was chaired by Dr. Atiq Rahman of Bangladesh Centre for Advanced Studies.

The Technical Session was chaired by Dr. Wester where Dr. Abu Syed from BCAS and Prof. Dr. Mashfiqus Salehin from BUET presented the up-to-date research findings which have been published or under review in HI-AWARE and DECCMA respectively. Dr. Syed showed how floods don't spell doom if planning and management are inclusive. To achieve this, it needs to include ecology and human systems taking into account in planning and management of river basins. Dr. Syed emphasized the key achievements of HI-AWARE research where BCAS contributed 14 working papers, 26 journal articles, and 21 stakeholder workshops conducted of which all the publications are online and freely accessible. He also emphasized that HI-AWARE findings may be used in the ongoing review of BCCAS, Delta Plan 2100 and Climate Smart Investment Plan (CSIP) by the Government of Bangladesh. Dr. Salehin in his presentation summarized the key achievements of DECCMA project where a national inventory of 589 adaptation measures was documented for entire country which will be published online as a living document. Dr. Salehin emphasized that environmental hazard has an indirect role on migration pattern in the coastal areas of Bangladesh.

The Panel Discussion-1: Flood, erosion and agriculture was also chaired by Dr. Wester where Dr. Mominul Haque Sarkar from CEGIS, Ms. Hasin Jahan from Practical Action Bangladesh, and Dr. Salehin from BUET were as panelists. Dr. Sarkar illustrated mainly the riverbank erosion processes in Bangladesh, while Ms. Jahan emphasized the temporary chars to be used for new livelihoods of most vulnerable people in the country. Dr. Salehin highlighted on the research on sediment transport in future to understand the climate change impact on it which would be very helpful for planning of the newly char created for better adaptations.

The Panel Discussion-2: Vulnerability and gender responsive adaptation in floodplains was chaired by Prof. Dr. Tasneem Siddiqui from Dhaka University where 3 panelists were present namely Dr. KS Murali of IDRC, Ms. Runa Khan of Friendship Bangladesh, and Prof. Dr. Umme K Navera from BUET. Dr. Murali focused on improving the quality of women's understanding as well as the capacity on the issues of climate change and livelihoods how to address. Ms. Runa Khan also emphasized the capacity building of women for empowering them while Prof. Navera pointed up the real lacking behind the issues which is water scarcity, if it can be solved, other issues would disappear.

The Panel Discussion-3: Climate change impacts on water at river basins: Upstream-downstream linkages was chaired by Prof. Dr. Imtiaz Ahmed of Dhaka University while Dr. Golam Rasul of ICIMOD and Mr. Khandaker Mainuddin of BCAS were the panelists. Dr. Rasul showed how will be the impact of cryosphere on which downstream areas are dependent during dry season where till 2040 the dry season flow will increase due to glacier-melt but what we will do after 2040. Mr. Mainuddin appreciated to inter-country collaboration on collecting and sharing data with equitable share and resources which are common in nature. Then the session chair Prof. Ahmed illustrated the river from different point of view where each river should have four things of water, energy, biodiversity and sediment (WEBS) for its own survival and we need to re-conceptualize the meaning of river where all these four things should be shared with the area where the river flows.

In the Closing Session, the Chief Guest Barrister Anisul Islam Mahmud from Government of Bangladesh was present where Dr. Atiq Rahman chaired the session. In the speech of the Chief Guest, Mr. Mahmud emphasized on large projects to be implemented in near future where large investment would be required in mainly agriculture sector for ensuring food security and economic development of the country. Finally Dr. Rahman thanked everybody to be present for the whole day.

Acknowledgements

The seminar organizer Bangladesh Centre for Advanced Studies on behalf of the HI-AWARE consortium expresses their sincere gratitude to the delegates from different government and non-government organizations of Bangladesh for their participation and contribution to the seminar with their valuable opinions. The HI-AWARE consortium would like to extend their sincere gratitude to the chief guest, special guests, session chairs, session presenters, and panellists for their contributions throughout the seminar for the whole day. The consortium highly appreciates the whole-hearted efforts of the professionals and supporting staff of the Bangladesh Centre for Advanced Studies (BCAS). Finally, the support of the UK's Department for International Development (DFID) and Canada's International Development Research Centre (IDRC) are gratefully acknowledged.

Inaugural session

Chair: Dr. Atiq Rahman, Executive Director, BCAS

Good morning friends. I can call all friends. This is the seminar where HI-AWARE shows the summary of the researches done by BCAS and the partners during last four-five years. Yesterday the Bangladesh Delta Plan (BDP) 2100 has been endorsed or passed or approved by the national economic council of the government. So, the timing of this seminar is quite right to incorporate the output of the HI-AWARE research to the BDP by understanding the global, regional and national dimensions and interconnectivity between mountains the Hindu Kush and the Himalaya. Himalaya is younger than the Hindu Kush. It holds the Gangetic delta which is the youngest in the world. As we know that there is huge uncertainty of climate change projections which are based on models. Now the modeling of one level is complicated, the other level is simple. When I come from my house to here, I have a model of route in my mind where my car will move fast to reach here avoiding the rash crowded road. But I got the heavy traffic in the alternative road. That is the uncertainty, you never know what will be in the future. My model was very good, the road was there, but crowded too which I wanted to avoid.

Therefore the uncertainty is built-in with every model. Fortunately the whole climate projection and other research are conducted under a larger program called CARIAA, the Collaborative Adaptation Research in Africa and Asia. And we will be talking the Asian experience in this seminar today. As you all know the planet is getting warmer except 1 or 2 people in Washington DC. However, yesterday, 250 km/h velocity typhoon hit and devastated huge amount in Japan. Now this one episode doesn't say that climate change is happening. But frequent such extreme events are indicative that climate change is taking place. Another example is 3 consecutive floods in haors in Bangladesh during last pre-monsoon in 2017. Bangladesh was a rice exporting country. Suddenly after that devastating consecutive floods, the country remains a rice importing country. Therefore, food security hampers. And our Prime Minister tried to increase the rice stock for the food security by importing from Thailand, Vietnam, and Malaysia. At the same time Myanmar government pushed one million people towards Bangladesh. Therefore, it is not a very easy decision in politics when you offer it. Politics is the world of reality. And our model is thinking and prioritizing departure where I can reach very soon.

So we are very fortunate that CARIAA program worked in different hotspots in the Africa and Asia. HI-AWARE is a river basin scale adaptation research under CARIAA which is led by ICIMOD, the regional organization with other partners like BCAS in Bangladesh, TERI in India and PARC in Pakistan. In HI-AWARE research, one important aspect to answer was high land – low land interactions in the river basins, or in other words glacier melting process and dependency on it which we are looking at in our research. There are more or less 1200 glacial lakes in the high mountains which are melting. The new phenomenon Glacial Lake Outburst Flood (GLOF) is a type of flood which is coming out from these glacial lakes within very short time. Normally, GLOF happens once in a very long time, but recently it is happening rather rapidly in time in terms of geological times. So, what happens in the high lands, has an implication what happens in low lands like Bangladesh. However, there are multiple series of dynamics which are parallel, simultaneous and complementary to each other. One, population is growing. However, after 1990s our population growth rates come down rapidly. For whose, all are needed more e.g., food, education, houses, health, infrastructure, roads, railway, waterway, etc. Nonetheless, future impacts in every sector in the country may hamper the development. If we don't prepare us now, there might be devastating disasters in future which may decline the growth rate and the development.

Now we are in sustainable development goals (SDGs) era. We are delighted to have Prof Shamsul Alam here who is one of the key people of BDP2100 working for last 30-40 years for eradicating poverty for achieving SDGs leaving no one behind. In SDGs all the government committed to eradicate poverty from the globe. Simultaneously, there is five year planning process. We are in the seventh five year plan now. We are moving towards the eighth. The NAPA 2005 and BCCSAP 2009 are also very good documents to work against the climate change impacts in sectors. Now we are revising the BCCSAP 2019 again and will include the research findings of HI-AWARE

(www.hi-aware.org) for the country where vulnerability may be reduced and resilience may be improved. So there is a planning process we have. And yesterday we have longer term horizon of this country. In all these things are happening geologically, geographically, and demographically. On top of that, climate change is operating. And sadly whether it is acknowledged or not that Bangladesh is one of the most vulnerable countries in the world. So question to all of us, that how do we manage all these simultaneously occurring dynamics of demands. Farmers demand is to ensure water for producing enough food in their field at the right price. Otherwise, if doesn't get the right price, we get enough food but they don't produce for next time where the system is not sustainable. So these are complex systems on which we are operating. We are lucky that there is CARIIA initiative from UK and Canada governments. Very shortly Dr. KS Murali will provide overview on CARIIA initiative from this side, and Dr. Flip Wester on HI-AWARE research from that side. And then we have Mr. Peter de Vries, head of water and natural resources management in the Netherlands Embassy in Bangladesh, a good friend knows Bangladesh well to work with the BDP2100 and other issues.

Delta Plan 2100 has been approved yesterday. But what happens in the high lands is a serious impact on low lands in terms of sedimentation process. As it is mentioned that Himalaya is the youngest mountain in the world, it is like a child growing up, so it falls down with huge sediment with its flows in the monsoon almost unlike any other delta of the world. We have to work with a huge sedimentation in large rivers coming from the Himalaya. With the sediment new lands are growing, but erosion is also taking place. So, it is very broad area with which we are talking today in a short period of time. After this inaugural session we have 4 technical sessions to follow with very distinguished panelists. Our chief guest will come in the afternoon at 3 o'clock in the concluding session. He has other political commitment earlier and requested to be part in the concluding session and he wants us to present him what we did here today for the whole day. He is a senior policy maker to take this at the highest level of the country.

May I now request Dr. Murali to present the CARIIA program on behalf of DFID of UK who funded this project and Canadian IDRC who managed the funds in a very good way. One of the great success stories of this project is that IDRC has given the research support with research monitoring and evaluation which is vital for a good project but very seldom that we have accustomed to it. So over to Dr. Murali now to focus on CARIIA.

Presentation on CARIAA

Dr. KS Murali, IDRC New Delhi

Thank you so much. Good morning everybody. My name is Murali. First of all, my greetings to all of you who have made the program quite successful. Especially for Bangladesh part who were involved. I will focus on the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) which works in 3 hotspots of Africa and Asian countries. We have supports from both DFID as UKAID and IDRC of Canadian government of about 70 million Canadian dollars. We emphasized the research of climate related issues e.g., typhoons, floods, and so on.



We also emphasized how people can come together. Primary idea was to bring the people of different sectors and countries together. Therefore, we started with four consortia on hotspot approach in deltas, semi-arid regions, and glacier-fed river basins. Four programs include HI-AWARE (river basins), DECCMA (deltas), ASSAR and PRICE (semi-arid regions). In Bangladesh two projects HI-AWARE and DECCMA are in place and working together as country table engagements. We also found some common themes in different consortia, e.g., gender related issues around the globe. Similarly migration is happening all over the world and in various pockets. The one which I want to mention which was common among consortia is adaptation and scaling. Adaptation in different perspectives in different countries is happening and how the scaling of adaptation is taking place.

I just want to give an example of adaptation scale. You may have heard a lot perhaps that Cape Town of South Africa has undergone a lot of water shortage. They control the water by rationing like one bath per person in a week is permitted, like that. Similarly for drinking water, everybody has to go to collect water from the supply points. That may be caused by climatic change which triggers dependency of bottled water by 50%. I think that is the thing we are looking onto what would be the scenario of future water demand and supply and how to manage that scenario with the lot of resources, materials and research documents we produced and available from other studies within our countries. I think that is the success of the program CARIAA.

I would mention some outcomes of CARIAA in South Asia which include DECCMA – government of Orissa has started to register migrants from other states; DECCMA – helped government to implementing gender sensitive policies; ASSAR – developing transformative scenario for water supply in various cities in southern urban centres in India; ASSAR – developed weather advisory for individual farmers using automatic weather stations (AWS) in India; and PRICE – impact of CC on value chain of cotton and appropriate policy measures in Pakistan. So these are some examples that governments deserves that CARIAA has produced in South Asian countries. And I am quite happy that Abu is here, Flip is here, and a few people are present here who will take this forward beyond CARIAA ended.

I have to stop here. I really love Dhaka and Rangpur I travelled many times. Thank you for the hospitality and hope to work together in future at least engaged in research on adaptations. Of course Bangladesh is the forefront to show the research in adaptations in cyclone perspective. And I hope this will lead adapting globally for the rest of the world to adapt due to climate change. Thank you so much.

Chair: This is our pleasure too to work with you for the last 4-5 years. Now I would request Dr. Flip Wester to present the HI-AWARE research in a nutshell. Flip is the Principal Investigator of the HI-AWARE research what we are talking about today. Over to you Flip.



Presentation on HI-AWARE

Dr. Philippus Wester, PI HI-AWARE ICIMOD

Thank you Dr. Rahman, and very good morning. Very good news to see in the newspaper in the morning that Bangladesh government approved the Delta Plan (DBP2100) although there are some criticisms in the newspaper. All are the parts of the game. I think it is good that we have that debate because, it is a long term plan where many people will argue about what is possible and what is not possible. So, it is great to be here today to see some of the friends with whom I have worked together in 20 years ago. That was Flood Action Plan which had 26 studies. Interestingly, BDP2100 has also 26 studies. I have found that interesting thing similar.



So it is great to be here today. I will talk about HI-AWARE research and I have been given 7 minutes to talk. So, our focus goes mainly to impacts which Murali has also focused already. I think Murali you are being too modest to inform you that the CARIAA is the largest program on adaptation research in the globe. So I thank to Murali and IDRC and DFID that it is a great leadership in adaptation research. And we are coming to an end now in terms of funding but not the impact of the research outputs.

Just speaking about HI-AWARE, we have developed 175 researchers, right? So, there is a community in practice there in South Asia that has been created and strengthened. Together with DECCMA working in Bangladesh and India, the relationship would continue in future. And also in HI-AWARE, we have really built the institutional partnership that can go forward. So, our focus one of course is the impact of climate change in water availability in supply and demand, what is happening in the glaciers in upstream in high lands in the mountains and what is happening in the downstream; then the gender vulnerability and socio economic drivers leading to vulnerability. And of course the adaptation practices in the ground understanding then trying to improve how development move forward. One thing is that HI-AWARE developed the critical moments that can be credited a little bit. And very important is the piloting of potential adaptation options in the field. We have learned from the pilots in HI-AWARE and will see how it would be upscaled. For example, climate and flood resilient housing which BCAS is conducting that pilot which we can learn from that.

We have 5 consortium partners namely BCAS in Bangladesh, PARC in Pakistan, TERI in India, ICIMOD in Nepal and WUR in Netherlands. And 6 strategic partners are helping us to achieve the goals of HI-AWARE. I would like to emphasize that 70% of our fund spent for research. Key achievements are 18 working papers published, 26 journal articles published, 10 PhDs (3 already defended), 25 MSc all from South Asia supported, 80 stakeholders' engagements activities, 60 blogs and 14 videos. We will discuss so much about our website today, but you can keep your eyes on that i.e., www.hi-aware.org. And you can also keep eyes on adaptation solution portal. In a few weeks time, this portal would be available when our final CCAPS conference will be held in Kathmandu this month.

So, going into contents, I would like to emphasize that high resolution historical climate dataset of 1981 - 2010 of 5 km spatial resolution is available now which was not available for the region. I am not going to the details, but here I just give an example of climate model outputs about number of hot nights which will increase for both scenarios of RCP4.5 and RCP8.5 in near future. Using this climate modeling to see when does it gets too hot. Our human body needs to be a bit cool at night to sleep well. So if you are sleeping in an environment above 30

degrees more or less, this also depends on the immunity and those kinds of things, so what we see in Uttarakhand in India, you can see at your left and right sides, with the historical climate data of RCP8.5 high-end climate scenario of projections, there will be increase of hot nights. I am just showing how you can use the information for your policy interactions to develop the country, e.g., important for city planners, local governments. I am just summarizing the research that by 2050 that is not too far away there will be large number of hot nights to be experienced. This is under 2 degree scenario, hopefully we can achieve under current emission scenario. In Pakistan there will be 60-90 days a year intolerable hot nights to experience.

We also looked at what is going on in rivers. I have bad news to tell you that the climate modeling results show consistency with the IPCC reports that there will be significant increase in flooding (will be double both in intensity and frequency) at the end of the century in the region. These information all are published in journals which you can use the ready reference.

Another is the impact of increase of 1.5 degree on sectors in the Hindu Kush Himalayan region as at the present the world is committed fully to limit the increase of temperature at 1.5 degree at the end of this century. For us in this region it is too hot, right? So, what we will see by the end of century, the increase of temperature would be 1.8 ± 0.4 degree in the South Asian region. If we go up in the mountains, we actually see it becomes even higher, 2.2 degree, etc. So even after 1.5 degree commitment, HI-AWARE research shows it is too hot in future. And what would be in the glaciers. You know by 1.5 degree increase 33% glaciers volume will be gone by the end of century. It is total disappearance that will not come back again. This is very significant loss of ice volume in the mountains. Even we can reach at 1.5 degree world, 33% of ice volume will be lost in the Indus, Ganges and Brahmaputra basin area by the end of this century. For 2 degree increase there will be 50% loss of ice volume at the end of this century. So, these have very high impact in science which has been published in Nature. Nature is a very good journal, right, the best we have. And I am very proud that HI-AWARE contributed this research and to be a co-author of this research. To publish in Nature, I just want to mention how was the review process of the journal. The review comments were very good with only a few methodological changes. The major comment was like this that the result is quite robust in terms of modeling works and it was published.

So, after giving that larger picture, other thing we investigated on the ground that people are experiencing crucial time due to climate change. We call this Critical Moments. We did a household survey of around 2000 households to collect information from quite older people who can say about the things of past 20-30-40 years. We are still working on the data but the preliminary results show more intense rainfall, more frequent floods, later onset of monsoon, more cold nights, more hot nights, etc. the results across the river basins that people are experiencing those moments. Now why Critical Moment is important is one for the adaptation option for both long term and short term. So, when it is too hot to grow wheat, for this kind of questions, we want to press first climate modeling, with people's perception on climate change and socio-economic drivers leading to vulnerability, and then the quantitative survey on critical moments, we want to make policy decisions through triangulation of evidences created.

So, after careful review of adaptation options, we have conducted a few pilots of adaptation option on the ground to upscale in the region: For example, BCAS has been conducting pilots with its partner on climate and flood resilient housing in Teesta in Bangladesh. We also did portable solar pump irrigation for small farmers in Pakistan where groundwater table is not so deep to increase the farmers income and resilience. Then we did eco-san toilets in Bihar (India), where many areas are flooded for 3-4 months in a year. So, we worked on raised structure for toilets that can be built only with 12,000 Indian Rupees where government or NGOs can provide subsidies for upscaling. This works really fine. Climate and flood resilient housing by BCAS also works fine with the floods hit in the area. These two can contribute to adapt with such a significant increase in floods. So, what are locally appropriate response and mechanism of adaptation that to take forward for the short term as we always look at the short term and also in the longer term as well.

That is all from me. I would like to wrap up. Thank you very much

Chair: Thank you Flip, you showed the insights of last 4 years of hard working across multiple countries, four countries in South Asia. Now I would like to request Mr. Peter de Vries to say a few words.

Special Guests

Peter de Vries, Kingdom of Netherlands Embassy at Dhaka

Thank you Dr. Atiqur Rahman the chair and to all participants and panel member of this seminar, I would like to say that I am humble to be here today and I was keen this morning to learn HI-AWARE research project and output key decisions. But I would like to be a watchman of the last 2 months' time passed for BDP2100 that was approved yesterday by the NEC that is very important for future of Bangladesh and also for Bangladesh-Netherlands cooperation.



I think BDP2100 is not just a plan; it is a vision for the future where Bangladesh wants to go for long term development and adaptive delta management.

Netherlands-Bangladesh relation is very close in terms of development plans, and knowledge transformation. The knowledge institutions of both Bangladesh and Netherlands can exchange the knowledge and research agenda for development. Another important aspect is of course the regional dimension of this BDP2100 where transboundary river basins were considered as IWRM where it is important for each stakeholder. It is also important for knowledge and research agenda in near future. I think we are entering in a new phase of implementation of BDP2100 by establishment of institutional relations in both countries especially for Bangladeshi research community and knowledge institutes. Now it is time for the international partners of Bangladesh to move further to concretize this BDP2100. Netherlands was technically helping in BDP2100, where the cooperation would increase when implementing this BDP2100. I think Netherlands will continue cooperating Bangladesh for implementing the BDP.

I would like to thank UK DFID and Canada's IDRC for funding this HI-AWARE research and CARIIAA program. I hope this research would also help and may be included in the BDP2100 for future reference and knowledge generated. I just want to congratulate BCAS to be institutionally involved and completing this research successfully. Thank you very much.

Chair: Thank you, thank you very much in deed Mr. de Vries. We are just very pleased to have Prof. Shamsul Alam with us. When any time we have requested him to for his presence as a top policy maker, academician to receive our works in the planning process, we always find his positive response. It is our pleasure to welcome him here and I would request him for his valuable speech.



Prof. Shamsul Alam, Member (Senior Secretary), General Economic Division, Ministry of Planning, Government of Bangladesh

Respected Dr. Atiq Rahman established BCAS for long, Mr. Peter from Dutch Embassy, and distinguished audience, very good morning to all. As Dr. Atiq said when he asked me to be present in any occasion, I tried to attend. But for the last long month, I didn't attend any academic or professional program, or even I should say any social program. You can ask

why. Actually I was preparing myself for making the final draft of Bangladesh Delta Plan 2100 (BDP2100) and presenting it to the National Economic Council (NEC) of the government in which all ministers and all secretaries are members. It was a bit challenging to convince them all. But, I could not deny this seminar because of respected Dr. Atiq Rahman, he requested me with so enthusiasm and as this seminar is based on the research outputs at the regional level.

I am quite pleased to be here to see that there is research ready for us in terms of water availability and socio-economic development and adaptations. Because during last couple of decades there are lot of transformation in our social sectors in many areas of Bangladesh and South Asia. It is very good time approving the BDP2100 because climate change is already affecting adverse impacts, upto 2 degree at the end of century particularly in water sector. Now I think all socio-economic development should consider or acknowledge climate concerns in the planning stage. I had opportunity to work with sixth five year plan for the country as well as the seventh five year plan where both didn't consider much on climate change impact issues. But our Prime Minister first talked to the Dutch Ambassador first expressing our willingness to have Delta Plan with the help of Netherlands. Why Netherlands? Netherlands is a unique country having well managed delta. And they also helped USA for Mississippi delta management. So, Netherlands is the one country of delta sciences.

You all know that climate change caused by temperature increase, uncertain precipitation, sea level rise, salinity intrusion, etc. All these are already experienced in the observed data, so scientifically it is robust and emerging field where IPCC AR5 says that at the end of this century the temperature rise would be 1.4 – 1.6 degree in worst case up to 2 degree. If it goes to 1.4 – 1.6 degree, in Bangladesh case, in one of the BDP2100 reports, the impact will reduce our rice production by 17%, and wheat production by 61%. I am just giving example of particularly in these two important crops as we are a rice grown country. It is very alarming to cope/adapt this situation. It is due to irregular rainfall, sometimes monsoon comes later, etc. You all know that Bangladesh is one of the most hazardous countries in the world, the ranking is five. So, Bangladesh cannot ignore this impact and climate change or environmental issues. Therefore, BDP2100 is very timely to have it for Bangladesh. It will be a living planning document which will be revised every five years. The country is divided into 6 hotspots based on homogeneous hydrological and distinct climatic characteristics and adaptation plans were taken for hotspot specific. It is not only a strategic plan, it is also an investment plan as well. We divided the time to short term, medium term and long term for these projects implementation. For the short term, we proposed 80 projects to be included in the BDP2100 in near future by 2030 addressing climate change adverse impacts, for example, drainage, solid waste, managing the riverbanks, managing waterlogging. For these 80 projects the estimated cost is 37 billion USD. We prioritized the projects on the basis of returns will be generating, and the problems addressing particularly to managing the rivers, removing sediments so that rivers can be managed properly. We cannot by anyway block the flow of the rivers. Our main theme of the BDP2100 is "Let the rivers flow, let the rivers live, we will keep rule for rivers to flow". We will channelize the flow by removing the sediment. Every project will include the feasibility studies for its sustainability, whether it makes harm or not. So, I should say all five year plans will be prepared keeping the BDP2100 in the front emphasizing and addressing natural hazards. BDP2100 is not only a plan or project, it is a gift of present generation to the future generation. So, Bangladesh has a visionary leadership now I think to visualize the development scenario by the end of this century which is very much encouraging I should say.

In BDP2100, we also emphasized the creation of knowledge hub. Because, planning should be more people oriented, where their opinions also to be reflected which needs to be based on data, socio-economic data, scientific data. So, creation of knowledge hub is very important for updating this delta plan. However, for implementing this plan, it is very important to develop our knowledge base and information base. So, this kind of seminar based on research outputs is very important for implementing our BDP2100. Only research would benefit proper planning in the socio-economic arena with climatic adverse impacts which would help in our BDP2100 implementation process.

Again, I thank you all for arranging and joining this seminar. And a big thank to Dr. Atiq Rahman who is working for long time with the climate change issues as well as socio-economic problems. I wish the success of this seminar. Thank you all.

Chair: Thank you very much in deed for your kind words and I am sure we will have opportunity to work in the BDP, in your eighth five year plan. We are coming at the end of this inaugural session.

Basically, this four year research project of rigorous efforts by five institutions, I would like to call it the club of the elbow where best institutions of their respective areas joined together, worked hard, and published a large number of papers 26 journal articles, and 19 working papers published and 22 under review. With all those we move forward, but remember there are four technical sessions waiting for you to be present. Then at the end there will be closing session, where our chief guest Minister Barrister Anisul Islam Mahmud will join at around 3:30 PM. Now I would like to end this session by handing over the recent publications to Prof. Shamsul Alam. Thank you all.

Technical Session

Chair: Dr. Philippus Wester, Principal Investigator, HI-AWARE, ICIMOD

I would like to welcome you in this session where HI-AWARE and DECCMA key findings will be presented.

Presentation: Dr. Abu Syed, Fellow BCAS

Dr. Syed began with presenting key messages, key achievements, and research findings from the HI-AWARE research activities in Bangladesh and piloting of Climate and Flood Resilient Habitats (CFRH).

Key message: Floods don't need to spell doom if planning and management are inclusive. Sediment management has to be addressed in flood management. It also needs to include ecology and human systems.

Elaboration: Floods may be manageable with the people's knowledge, what people say as a solution if we take the ecosystem into account. Farmers in South Asia always coexisted with floods, they live with floods for many years in the floodplains. And they know very well how to live with the flood. But they don't know how to deal with the extreme situation when it becomes very devastating because of this global warming or change in rainfall situation here. This brings lot of sediments which was not in previous. It creates lot of braiding in the rivers. It also creates problem in downstream as well. So the question is how to live with this changing situation of extreme condition. And how did we come to this key message, i.e., how did we learn this we have seen in Flip's presentation earlier that we have done so many of scientific publications. About 30 researchers worked at BCAS in this research project and contributed in the research as regular researchers or consultants.

Key achievements: BCAS contributed in 15 working papers and 26++ journal articles. We had 1 out of 10 PhD students, 1 out of 25 MSc students from Rajshahi University. BCAS conducted 21 out of 80 stakeholder workshops in Bangladesh at national and local levels.

One important thing I like to mention that today is the fifth anniversary of HI-AWARE proposal on September 5, 2013 submitted to IDRC. This is the very day we submitted the HI-AWARE proposal and conducting the final stakeholder dissemination of research results.

Our two videos are online: one is on floods titled "Flood affected people of Teesta"- <https://www.youtube.com/watch?v=WUpCK34wwiE&t=123s> and another is on water scarcity in dry season (drought condition) titled "Thirsty Teesta"- <https://www.youtube.com/watch?v=ep3EIQUSL7M&t=716s>. If you go to the website www.hi-aware.org you will find all the publications as well as videos there as well. These are all open access. You can download anytime. The flood video is well accepted internationally and everybody appreciated that one. The video elaborates projecting the challenges of women and children and adolescent girls facing challenges during flood. The water scarcity video is also well accepted when people in char lands are really vulnerable only due to water scarcity. Women need to collect water from a distant source which is already polluted, but still they are satisfied with this polluted water as it is the only source of water there.



So when talk about flood management, sediment management also has to be taken into account. Sediment management is not really addressed during last few decades, when we invested a lot on riverbank erosion management by building embankments for flood management. Here it requires a balance between ecology and human system that I mentioned already earlier.

So the innovation we created at the community level that built actual resilience of the benefitted community. I will give the example how we achieved this. Climate and flood resilient houses (CFRH)¹ are the solution. By understanding the local technologies, e.g., safe drinking water, sanitation, solar home system, improved cooking stove, natural technique of vetiver and other grasses to protect toe of the boundaries from erosion. All these are implemented in the CFRH. So CFRH would be a better solution what we have seen so far in the floodplains.

Therefore, the great question is where this CFRH can be upscaled? This is the one where we evaluated the potential areas of upscaling from the stakeholders in an event in Kathmandu, Nepal in December 2017. We asked the stakeholders where CFRH would be replicated to stitch on a large map of South Asia. People showed all the floodplains may be replicated with the CFRH.

Study area includes Teesta basin in Bangladesh initially at 8 upazilas, after that 4 upazilas namely Patgram, Hatibandha, Dimla and Kaunia were focused to studies. Our CFRH are in Kaunia, Dimla and Hatibandha.

In this slide you will see the climate projections in the IGB basins which Flip showed earlier, so, I am not going to elaborate that. But I would like to show you the climate projections further downscaled in Teesta basin. Climate projections show that temperature and annual rainfall both are increasing. Total volume of rainfall is not much changing but the variability and distribution in different time is a great problem for especially the crops and there is also intense rainfall in short period of time which generates floods. Total annual flood will increase more in upstream areas than the downstream. Therefore, it will cause the flash or seasonal floods. Daily maximum, average and minimum temperature all are increasing in the long run. So, there might be high temperature for human health that will not be comfortable. Consecutive dry days are also increasing that means, rainfall is erratic for which there will increase the irrigation demand in future. Number of hot days will also increase.

In our heat monitoring study in Dhaka, we found that very congested areas like slums are quite hot than the surrounding area about 5-7 degree centigrade higher. We monitored both indoor and outdoor temperature. For indoor temperature, we put around 60 temperature and humidity sensors in the bedrooms of the top floors of buildings. Normally people don't want to put the device in their bedrooms, but we convinced them to put it there by giving chocolates and other small gifts. Few of the sensors were lost due to changing house of the tenants mainly. But still we have good data of 50 sensors. You have hot days, and less rain, intense rain in few numbers of days. So you have two extreme situations. For the outdoor measurement, we put a portable device on the roof of a white car and made transects of temperature at the roads. We selected holidays (Friday and Saturday) for these transects for moving fast in the roads.

Here is the map of outdoor heat measurements in three cities, Faisalabad (Pakistan), Delhi (India) and Dhaka (Bangladesh). This map was produced by upscaling of outdoor and indoor heat measurement by classifying different housing conditions for example tall buildings, normal 4 - 5 storied buildings, congested slums etc. The congested slums are the most heated areas where indoor temperature is 10 - 12 degree higher than the outside normal temperature because of corrugated iron sheet made roofs and no or little space for air passing. In a reference we see that 18.5 degree is the most suitable temperature for sleeping. We still considered 25 degree. But if our outdoor temperature is 28 - 35 degree and indoor is 6 degree more, so how comfortable is the temperature in Dhaka you can see from this map.

¹ Piloting CFRH: BCAS, HI-AWARE team piloted climate and flood resilient houses (CFRH) in Teesta floodplains. In total 12 CFRH were made in two types. One with traditional houses retrofitted; and another is portable wooden houses (PVWH). PVWH is practiced successfully for long in Ganges floodplains which was very expensive. However, in Teesta floodplains, we modified the house with local low cost materials as well as added technology for lasting long the local woods. During last devastating flood which is considered as 1 in 25 years flood, our CFRH didn't inundated under flood water. Many people visit the new houses to make for themselves. A number of carpenters, saw mill operators were trained to make available the local wood materials for the houses. Therefore, CFRH would enhance people to living in the flood prone area.

Contrast /extreme situation during monsoon and dry seasons are there. Flood in monsoon and water scarcity in dry season are observed.

We have found that river course has been changed a tremendously where flow reduced by 80%, farm land and settlements lost due to river course changes. You can see the bank lines of 1989 to 2016, and how river courses are changed. Displacement of Mr. Ramjan Ali in Char Haibatkha was studied. He changed his house 12 times during last 15 years.

What are the solutions? There will obviously be a combination of planned and autonomous adaptations. Planned adaptations should include the riverbank protection by both structure like embankment and spurs, and soft solution like afforestation to protect the bank line and the chars as well. I am just showing this satellite image (downloaded from Google Earth) of Teesta river where it enters Bangladesh at Patgram of Lalmonirhat. You can see very easily that in Bangladesh side, the river is encroaching to the land and 3-4 km by last 10 years. But if you see the other side in India, you will see that the river is protected both with structure of embankment and small spurs at 200-300 m distance and afforestation at both the bank and at the char to make it permanent. And it works very nicely together which we should also follow to protect the land and properties. We can also follow that one, but we need to relocate a number of people from the area. However, if we want to live with floods, we need to improve the lives and livelihoods of the people. This would obviously reduce the vulnerability where people want permanent lands for them, while autonomous adaptations are also to be upscaled in many areas. People are already adapting autonomously like maize cultivation, crop diversification due to mainly portable diesel pump for irrigation in the charlands.

In our CFRH, we found that the houses are not inundated during last 2 years floods, out of 2017 flood was devastating during last 2 decades. First when we started working there in the field, we found that people want houses of mainly two types: one the house should be portable to relocate; and another is, the house should be at raised platform or on columns where flood water can pass under the house which is practiced in Munshiganj in Ganges floodplains for long time. We have also seen that many people in the study areas built their houses on the columns made of RCC which are locally commercially available. Then we took the carpenter (wooden house maker) from Munshiganj to Rangpur for making the houses. The carpenter provided training to the local carpenters. Then a specialist from Bangladesh Forest Research Institute (BFRI), Chittagong provided training on wood preservation technique to the carpenters. Then the trained carpenters made the houses themselves applying the perceived knowledge from the on-the-job trainings. You can see the picture of the houses we made in this slide. We first raised the land at above the flood levels. Then we made the house cluster. You know in rural Bangladesh the traditional practice is that the houses are like a cluster of 4-5 houses surrounding a courtyard where close relatives live together in that cluster. So, we developed 4 similar clusters with 16 houses in different areas of Teesta floodplains in Bangladesh.

So, how the CFRH works in the floods? We raised the plinth of each cluster 2 feet above the highest flood level mentioned by the community they remember. So the result is that no house was inundated in 2017 floods. In 2017 there were couple of floods of which August 13 flood was devastating with recorded highest flood levels when more than four hundred thousand houses were damaged or lost.

Another important thing to mention, we summarized all the adaptation practices in the field and the piloted solutions and put it in the adaptation solution portal, a website which would be ready with enough materials very soon. So if you visit that website,

This is the end of my presentation. I would be delighted later to answer the questions.

Chair: Thank you Syed for doing great works as part of HI-AWARE in Bangladesh. It would be very useful for upscaling in other areas in Bangladesh. You may be happy to know that there is also great interest on CFRH from Bihar, India and from Pakistan if some houses could be replicated there. So it would be great if we could make a few houses there too. So, in HI-AWARE it was nice to learn from each other among the partners in different locations.

Now I would like to move on to DECCMA. Salehin is going to present the work done by DECCMA in Bangladesh.

Presentation: Professor Dr. Mashfiqus Salehin, Co-PI of DECCMA project at IWFMBUET, Bangladesh

My name is Mashfiqus Salehin. I am a faculty in the Institute of Water and Flood Management of Bangladesh University of Engineering and Technology. People who know me they know that I cannot finish my presentation on time. I don't know how much time I will be given here. It was supposed to be a half an hour session but started very late and Syed already took about 20 minutes and I don't know how much time I can spend.

I have a detail presentation, but I will give you a flavor of DECCMA project what we did in last four years due to time constrains. DECCMA stands for DELtas, vulnerability & Climate Change: Migration & Adaptation. Of course, it is not only the GBM delta we focused on, both sides of GBM delta in Bangladesh and India, but also delta of Mahanadi river in West Bengal of India, and Volta delta in Ghana. I tried to capture different physical and socio-economic dynamics, tried to understand the vulnerability with different socio-economics drivers in these deltas. Overall the project is led by Southampton University in UK. From Bangladesh, BUET is a lead partner. But there are also other very important partners in Bangladesh namely RMMRU, CEGIS, WARPO, BIDS, and few other government and non-government agencies. DECCMA aims at evaluating effectiveness of adaptation options in deltas mainly after understanding the migration pattern in context of available adaptation choices in delta environment under the changing climate and to deliver policy support for sustainable gender sensitive adaptations in the region. There was a few focuses. One was adaptation which we tried to understand what kind of adaptations are practiced in Bangladesh over the years, and to what extent they are effective in terms of land and effective operation, and where migration stands in all the autonomous adaptation choices, why people migrate and how we can enhance the adaptive capacity of the communities to reduce migration, or if they migrate what we can still do for them.

So the methodological framework was divided into a number of work packages. We looked into the governance system, and the stakeholders. Efforts were given to policy analysis in terms of migration and climate change adaptations. Since we worked in the deltas, we also worked on climate and biophysical mapping of deltas. We mapped hazards, vulnerability and risks through some biophysical modeling tools for baseline and future scenarios. We also conducted extensive socio-economic survey to capture the migration dynamics, how people autonomously migrated. We created an adaptation plan with adaptation inventory, and we are very excited about it.

One of the important components in the methodological framework is the economic impacts of climate change by macroeconomic modeling. One major focus was hazard, vulnerability, climate hotspot and risk mapping in coastal region of Bangladesh. The idea was to understand the magnitude and location of impacts, where and how much vulnerability is there at the present time and where vulnerability will grow more in future and what kind of adaptations would be required. If you read our BCCSAP 2009, you find only the maps of hazards and those have been used so far as a guiding document to identify adaptations. There is already a discussion that rather than looking at only hazards, we need to look at more on risks which is a combination of hazards, exposure and vulnerability and you can conceptualize the adaptive capacity in it. But hazards are still very useful for present day hazard into account. What if you build more polders in unprotected areas, what will be the impact if you increase the heights of sea dikes and polders, what if you implement afforestation in the sea facing polders. So, the hazards map is useful for these planning what we and other people propose. It is very important know that we produced risks maps. Along with hazards map, risk map would reduce the socioeconomic vulnerability, so we created both maps. We took IPCC AR5 approach. We used a number of climate models and scenarios and our own hydrological and hydrodynamic models for forecasting salinity, cyclones and storm surge height, for creating baseline and future maps. We also evaluated the socio-economic vulnerability on the basis of 30 indicators of exposure, sensitivity and adaptive capacity in the coastal region of Bangladesh. The risk maps show that the eastern coast is more exposed to cyclone and storm surge and sea level rise and salinity than in the west. We think that this kind of information is very useful for the policy makers, for formulating plans in adaptations.

Most adaptations focus on disaster risk reduction. CCA is more explicit after NAPA and BCCSAP. Still there is lack of guidelines of how to address the climate change impact and adaptations. BCCGAP 2013 includes the gender responsive adaptation options.

A national inventory of 589 adaptation measures for entire country was found and published online as a living document. We also mapped the number of adaptation measures in whole Bangladesh district-wise where we found in the coastal areas, adaptation measures are larger than fluvial areas of the river course and also deviated from other coastal areas. DRR is found the most important and practiced adaptation in the region where the government is the most providers of adaptations in Bangladesh which was quantified as 87% while the rest is provided by NGOs and private sector. There is also difference between the adaptation triggered by in coastal area and the rest of the country. For example, 75% of adaptation measures are triggered by long term impacts like salinity waterlogging (adaptations) and 25% focused on sudden shocks (coping). Majority of adaptations were reactive in Bangladesh, some of them have been anticipatory. DRR received the most attention for reduction of socio-economic vulnerability that is good. But building ecosystem resilience received less attention. However, most people opined that ecosystem resilience should get priority that is good thing. Khulna, Satkhira, Bagerhat receive more adaptations than other districts.

We also evaluated the migration situation in the area. The existing situation is like this internal migration is like 10-12% while international is 18%. But the trend of the rate of internal migration is higher than the trend of international migration from the region. When we asked people the reason of migration, the people don't perceive the environmental causes as drivers for migration. But if you go in deep, the main reason is economic development where many of economic reason is triggered by environmental hazard. So, here environmental hazard has an indirect role on migration. The key message about the migration is that displacement due to climate extreme enhances the migration process rather than economic opportunities in the migrated areas.

That is the end of my presentation. Thank you.

Chair: Thank you very much Salehin. Adaptation inventory would be a valuable product. I would also invite you to see the adaptation solution portal of HI-AWARE. If these are open source in the website these would be a very good resource for the region. Officially there is 1 minute to go for lunch. Alternatively here is question and answer session to two presenters as well as Panel Discussion 1 on flood, erosion and agriculture of which I am the chair again before lunch. So what to do, do we go for a short lunch and come back again or have a short panel discussion and go for lunch then. The audience agrees to stay for panel discussion. And we don't know if the lunch is ready or not. So, now I would like to open the floor to ask the questions to the presenters.

Q-A session:

1. **Mustafizur Rahman from IDCOL: What are specific role for private sectors for adaptation measures?**

Dr. Salehin: We didn't go into the role in adaptation measures. But the information has been collated that who will be provider of each adaptation where which government organization or NGO will do it. But we didn't separate any role for private sector. However, it is a very important question to answer. We were also asked in many forums this question. Then we had an extended evaluation and discussed in the last Annual Learning Review (ALR4 in Cape Town) that this aspect will come.

Dr. Syed: In our CFRH we engaged the private sector. The idea is that they private sector would take the design of the house and the upscaling can be implemented by private sector. It is a prefabricated house, all the panels are separate which can be made earlier and transported to the location where it is to be built. So, the building material providers can make these panels and available in the market like we buy the corrugated iron sheets. So the provider may build different size of the houses in parts and sell in the market. We also trained a number of different people, carpenter, and saw mill operators who can go for upscaling. As it is a research project, we cannot go beyond the research, now providers may come further to us too, we will give support them to take the design for marketing.

2. Ms. Dilruba Haider, UN Women: How is the cost of CFRH? And the other one on how you include gender specific adaptations in DECCMA?

Dr. Syed: The cost is variable. The problem is that people in charlands don't have the land for making houses. The cost deviates with the materials used in the houses. If you use the expensive LOHA kath (iron wood) it would cost more than the locally available cheap materials. It may cost 70,000 -250,000 BDT for each house. Because the variability is mainly due to labour cost. People who want to make the house themselves, the cost would be around 70,000 and who wants to make by others like a carpenter it would cost much more like 250,000.

Dr. Salehin: I am not a specialist in migration. Our specialist Prof Tasneem Siddiqui will be the chair in the after lunch session, so hopefully, she could answer you the best. And another is Dr. Anwar from BIDS. I cannot give you any number. But there is residual in the collected data that there is women migration increasing in terms of garment workers. In the household survey, mostly the male members of a family migrate for income generation from outside the area, but in many cases, female members also migrate like the males for income generation may be due to female headed family. But I cannot give any numbers.

3. Zakir Hossain, NETZ Bangladesh: Where the CFRH may be replicated in other parts of the country and how to replicate with local materials because tin roofs may be harmful for human health because of high temperature?

Dr. Syed: We used ventilation for air passing cold air enters from low part, hot air goes out at the upper portion of the house. So the windows are arranged in such a way that cold air enters from the bottom part of the house and goes out at the upper portion that is implemented in the house. More importantly, houses are two-storied, so the ground floor has a wooden roof which is colder than the tin roof. But during night the upper story receives much air than the lower story.

4. A person from Department of Livestock (didn't mention the name): What is the mechanism for riverbank erosion?

Dr. Syed: It is an alarming question to protect the house. Locally, the soil will not erode due to hedgerow along with vetiver grass protection. But for riverbank erosion, you have to have large level protection; therefore, we need the basin level management what we proposed.

5. Md. Mahashin, Deputy Director, Department of Agricultural Extension: What adaptations for agriculture you propose? Another question to Prof Salehin that you showed percentage of adaptation at district level, so how did you get this percentage?

Dr. Syed: In fact as Salehin also mentioned that we could not get time to go into deep how we did we assess the adaptations. We first reviewed the literature of adaptation practices, then got extended list of adaptations from qualitative assessment in the field. Then we conducted the prioritization of adaptation practices in three level of stakeholders at the community level, at local Upazila level, and finally at the division level at Rangpur, all by stakeholder consultation workshops. Mixed cropping became the prioritized option for adaptation. Second is maize cultivation for charlands. We also did cost-benefit analysis of most promising adaptations in the field from which a paper has been submitted to a journal 'Water Policy' now is under review.

Dr. Salehin: How we estimated the percentage of adaptations? As I mentioned most are based on secondary information, documents, journal articles, published reports prepared by various government and non-government agencies. Then we have sent the list of adaptation options to the stakeholders mainly government organization for validation. Based on those data of different projects implemented and their study area of extent in different districts, we made the percentage of district-wise map. A number of options are there, but we need still to validate those information. But as I mentioned it is a living document, we can update it with the new information in future.

1. Panel Discussion

Flood, Erosion and Agriculture

Discussion points

- Practice of compensating of land lost by riverbank erosion, recommendations
- Fair distribution of Khas land among the poor, how to improve the governance around it;
- Resettlement practices and recommendations on government initiatives
- Fair allocation of BCCTF and climate finance for north western region.

Chair: Dr. Philippus Wester, Principal Investigator, HI-AWARE, ICIMOD

It's my pleasure to invite the panelists to sitting here with me Dr. Mominul Haque Sarkar from CEGIS, Ms. Hasin Jahan Country Director of Practical Action Bangladesh, and Prof. Dr. Mashfiqus Salehin, you are already here, or you may change the seat. We will shorten this panel discussion so that we can have sometime for lunch. Our chief guest is coming around 3 o'clock. We would like to have another 2 panel discussions and give adequate time to the chief guest.



I just quickly confirmed from my panelists that we will try to speed up. But introducing the topic would be by Tanzina from BCAS and hopefully you have very short introduction. So we are looking at flood, erosion and agriculture. I hope we will get answers from the panelists here about the flood, erosion and agriculture.

Presenter: Ms. Tanzina Dilshad, Senior Research Officer, HI-AWARE, BCAS

My presentation topic is flood, erosion and agriculture. Before going to the topic I would like to mention a few outputs of HI-AWARE research. From the climate change projection, in Teesta basin annual total precipitation will increase by 3 – 104% from present condition in various scenarios. This indicates that extreme precipitation which is ultimately causes flash floods in the upstream Teesta and seasonal floods in downstream Teesta.

Critical moments also increased in qualitative and quantitative assessment in agriculture both in kharif and rabi season. Our study area was in Dimla, Hatibandha and Kaunia. When we conducted studies of socio-economic drivers as well as critical moments assessment, we found from the community that T-man rice is the main victim of floods in agriculture sector. In the quantitative household surveys, 77% reported flood changing pattern in last 10 years, of which 55% reported increase. Flash flood, sand deposition, and riverbank erosion also increased which hamper agriculture in the areas. They also opined that sudden floods increased more at present than before. We



cannot prepare ourselves for these sudden floods which occur from pre-monsoon to monsoon period. The sudden floods cause sand deposition on agricultural land for which first the standing crop is lost, then the land is not suitable for agriculture if the deposited sand is not removed. They also opined that this is the result of both natural system and inadequate river protection works.

Water shortage for irrigation is in near future. It will also increase the water scarcity in dry season for drinking water supply.

Response measures in agriculture include HYV of Taman, maize, peanut, onion, mixed and relay culture, sandbar cropping, short-term migration, etc. Among all, short-term migration creates a lot of overburden to women to manage all the activities e.g., household works, agriculture, collecting drinking water, and other jobs. However, in the char lands, the transport of agricultural product is a major problem there which fails to supply the product to the market in time. So, people requested, if any new adaptations in agriculture introduced to the areas, please also consider the transportation and market linkage problems.

Conclusions: Structural and capital dredging enhance carrying capacity of rivers; and an institutional framework of flood and riverbank erosion management from national to community level to be taken into consideration.

Chair: Thank you Tanzina for the overview. So now looking at my 3 panelists, and looking at Tanzina's presentation, I would ask, may be Momin you have the first reflection on the topic based on you long experience of sediment management in the country?

Panelist:

Dr. Mominul Haque Sarkar, Deputy Executive Director, Centre for Environmental and Geographic Information Services, Dhaka, Bangladesh

Chair and audience, I am just talking about some of river erosion in Brahmaputra river of which Teesta is a tributary. First thing is that the dynamics of erosion and accretion is very high. In Bangladesh, major rivers are of similar characteristics. My experience is mainly on Brahmaputra river of which Teesta is a tributary. The river is widening year after year. But we need to control the widening of the river. But it needs huge investment from the government. Officially, there is no erosion in the area because people are paying the holding tax for the lands, and the government found there is no erosion.



During 1970 – 1980 the major rivers of Ganges and Brahmaputra were very deep, not so wide. After 1980s these rivers started widening and took nearly 50,000 km² in last 3 decades. At the same time the chars are made in the rivers (accretion). Out of all chars, around 50% are new i.e., 2 – 15 years of age, 25% are quite old > 15

years, and rest 25% is unstable.

We don't know still the specific causes of this increasing widening of the rivers that might be due to earthquake or climate change. So if it is due to climate change, it should be investigated further to be sure.

About resettlement: Now the chars are treated as resettled area where solar panels play a role for energy supply. As UNDP funds the char dwellers for resettlement in the chars, they can make an inventory of erosion-prone area and vulnerable people and ask the government to relocate to more stable areas. Then the government can start their resettlement so that the more vulnerable people can be saved. However, char people is really vulnerable and they are very poor. They cannot be out of danger any time; however, this should be taken into consideration in future.

That's it from my side. Thank you very much

Chair: Thank you for deep insight about the issue. Keep in mind that, river is a very dynamic system. You need to be very careful if your house is at the bank of the river. Now I would like to get the thoughts of Ms. Hasin Jahan.

Ms. Hasin Jahan, Country Director, Practical Action Bangladesh



Thank you very much. I would like to speak in Bangla as it is the time of before lunch then our brain doesn't work much. I have always a high regards to the researcher. We who works for implementation, we cannot be neutral. In recent days in chars, farmers cannot work for long in summer and under hot sun. Now they need to come back home by 11 am especially in char lands, and coastal areas. One useful adaptation would be raised land for livestock during floods.

In my understanding, chars are created by rising the river beds year after year. So, will we grow rice as we have done

so far traditionally year after year, or is it the time grow new products in those areas. We have seen you proposed for a very good house that would sustain in the floods. But in my experience I have seen that you need to arrange some livelihoods near the house. If the livelihood area is far from the house, it would not be sustainable any more. We also thought a comprehensive housing pattern, you can think of that. That comprehensive housing pattern include a cluster of houses where a multi-purpose livelihood centre will be there where cattle-sheds will exist, and other small non-farm activities can enhance the livelihoods of the people living there.

About resettlement: Distribution of khas land is a governance issue. But I would emphasize that which lands are treated as chars. Normally we call it a char, when a sand dune is older than 2-3 years and quite stable to grow crops and living is possible. But we see that apart from these stable chars, river beds are going high year after year especially in Teesta and Brahmaputra rivers where there are temporary chars are created. On behalf of us, IWMI studied that 0.2 million ha of this kind of temporary chars are created every year in the major rivers in Bangladesh sustain 6-9 months which we can use as agricultural land. Some time ago, Tanzina was telling about the pumpkin cultivation in the chars. Behind this pumpkin, Practical Action has some contribution in the field. This will be included as a potential adaptation option in the recent agriculture policy of 2018. In those temporary chars, pumpkin may be a very good adaptation option including market linkage. Actually all products in agriculture need to have market linkage at the end. So we need to work a lot in making market linkage in future. So, only production is not a solution, market linkage to every product is essential for sustainability of any adaptation. It is like a part of the system, if one part doesn't work, the whole system will collapse.

Finally I would like to say about the displacement due to riverbank erosion many times. My experience is that women who are clever, they migrate, who is not clever enough, overburden by many household jobs, are left in the area and remain vulnerable. I would recommend changing and thinking about the gender related views by the society. At the end, we need to make every sector gender sensitive, i.e., household works gender sensitive, working at the land gender sensitive, other livelihoods gender sensitive. Thank you very much

Chair: Thank you, nice to hear that pumpkin is coming back with the market linkage. We have the final panelist to talk. Please make it very short.

Prof. Dr. Masfiquis Salehin, Institute of Water and Flood Management, BUET

Good thing is that I didn't know that I have to be in the panelists. But I will try to answer the issue from my experience.

Floods have many positive effects too. For agriculture, timing of floods is very important in terms of crop damage. If farmers are prepared for floods, the damage is reduced. Therefore, understanding risk of floods is very important. In the crop calendar, floods are not restricted to only a couple of months like in previous. Now it is coming when there is no risk of flood like, last year on 28 March a flash flood in haor region devastated the standing rice crop which is the only crop in a year in that area. So, we need to understand the flood risks first. Then the adaptation of rice variety to upscale. There are a number of high yielding or short duration rice varieties existed but not adequate for the whole country. If the seeds are available for larger amount, we can produce more this kind of varieties which can reduce the vulnerability.



Sediment transport is increasing due to climate change. Human interventions also cause sedimentation and riverbank erosion. We need to understand the sedimentation process too much or too little. After that we need to adapt with the changing situation. I am not comfortable to hear about an opinion of people about water that in monsoon we have too much of water and in dry season we have too little of water. But I totally disagree with this that monsoon water is essential for our ecosystem development. Our concern is only the events of moderate to extreme floods. So we need to understand is it really too much sediment generated which may be very useful for us. If it is useful, we need to plan accordingly. I would stop here. Thank you

Dr. Sarkar: Before closing the session I would like to answer that too much or too little sediment both are bad for the river for its natural flow.

Chair: Thank you all the panelists and Tanzina for making the session a very live session. I like that too much water. We will go for lunch now. We have exactly 31 minutes for lunch and please come back at 2:30 after the lunch.

2. Panel Discussion

Vulnerability and Gender Responsive Adaptation in Floodplains

Chair: Prof. Dr. Tasneem Siddiqui, Chairman, RMMRU DU

I would like to welcome you in the AFTER LUNCH session of this seminar. I would like to invite Dr. Dwijen Mallick for his presentation on the issue in this seminar.

Presentation by Dr. Dwijen Mallick, Director BCAS

I will emphasize on approach of vulnerability, key climate stresses, social drivers and conditions, and coping and needs for gender responsive adaptation

Climate change is not gender neutral. You know that climate change is affecting badly differently on man and woman. Women are more vulnerable than men.

Growing gender inequity and vulnerability: women are more vulnerable than men because of existing social norms and conditions.

Approach is mainly based on qualitative assessment of participatory tools and methods. It follows the IPCC AR5 methods of vulnerability assessment of resilience and risk framework. The study areas include 12 sites of 4 river basins of Indus, Upper Ganges, Gandaki, and Teesta.

Findings:

Key climate stresses are common. But micro climatic factors and disaster matrix differ between upstream and downstream regions. In downstream areas, floods, riverbank erosion, heat and cold waves, and drought are common. Poverty is the main issue of not getting out from this vicious circle. Additionally, climate change adversely affecting the situation.

Major social drivers in upstream area are remoteness, poverty, marginalization, social exclusion. In downstream area, similar social drivers also are seen. Additionally, in char lands, in monsoon flood affects adversely when no work is there, men migrate for short time and lives of women left behind remain difficult. Poor women face particularly inequity, inequality and marginalization.

At the community level, mainly coping strategies are seen. In Bangladesh, DAE introduced climate schools for training the vulnerable women. Promising adaptation practices should be upscaled in greater number to increase resilience of the communities.

How to achieve gender responsive adaptation? Key areas may include the adaptation practices where women are involved more to be upscaled. For example, in poultry and livestock sector, increase cattle and goat rearing, raising cattle sheds during floods, providing necessary financial and technical support for livestock rearing, etc.



Key messages are:

- Adaptation measures would be effective if these are planned considering both climate change impacts and social conditions.
- Adaptation measures short- long term to be integrated into regional and sectoral development initiatives.
- Poor needs more resources, motivation, social organization, adaptive capacity and technological supports for reduction of risk and vulnerability.
- Social protection measures, enhancement of human capital and livelihood diversification are needed.
- Root causes of poverty and inequity and vulnerability are to be addressed in the policy and practice.

Thank you very much

Chair: Thank you very much too. I think you brought us the core issues and the policy recommendations you suggested targeting SDGs. So all the development along with climate change that would need to be done in future for reducing the vulnerability to climate change. We will also ask the distinguished panelists the issues you presented, and we are also asked the following three key discussion points to be addressed in future.

Discussion points

- How to make Government and NGO initiatives of adaptation practices in floodplains more pro-poor;
- Legal and ethical aspects of char development in Lower Teesta and Brahmaputra; and
- Gender responsiveness in adaptations practices.

For helping the discussion I would like to say that climate change when you go to rural areas it is very true that people don't differentiate stresses directly to climate change and stresses related to social, economic and political. For example, in Sundarbans, people who collect honey, they asked to protect them from the robbery of honey. So this is very much political issue. So we need to see the whole picture from a broader canvas. Only seeing the issues by this broader canvas will bring in all inclusive to solving the problems. Let me now ask Dr. KS Murali to say his comments on this presentation and the discussion points.

Panelists:**Dr. Kallur S Murali, Senior Programme Officer, IDRC New Delhi**

I lead a group of gender and social equity of CARIAA. We have conducted 25 case studies in this group. In the group, it was tried to answer the great research question, how we can address this gender inequality issues in the society. We found that there is not enough institutional support for improving the existing situation. We came to consensus to address this issue that if we can distribute the jobs in different institutions both in government and the NGOs for improving this. Because political things should be addressed mainly by the government while socio-economic issues may be addressed mainly by the NGOs. Next, we need to improve the quality of women's understanding as well as the capacity of women on the issue how to address the things. Therefore, if we can address the major livelihood issues that would improve the socio-economic conditions it may resolve many issues including gender inequality.

Chair: Thank you very much. I think you addressed the core issue of gender responsiveness itself that is our focused issue in this discussion. May I now request Ms. Runa Khan to make her comments on the issues.

Ms. Runa Khan, Executive Director, Friendship Bangladesh

Assalamualaikum and thank you very much for inviting me in this special session. Friendship Bangladesh started working in 2002 in most vulnerable climate impacted areas for making awareness of women. But it was very

difficult to deliver services and address the issues because communities are very vulnerable while every climatic event makes them poorer after poorer. It is a huge failure of whole livelihood system, because when disasters affect each time, the lives and livelihoods are not sustainable for the community.

So we needed to build a system for our service delivery to the communities. Every day we used to discuss the issues how to address. When male members migrate to earn money from a distant place, women and children are left behind. Communities need three things: opportunity, dignity and hope for tomorrow, it is very difficult to work with them without these three things. Therefore, an NGO works first with these three things, then with their main goal or objectives in the field.

Empowering women is first should be from building the confidence level by training. One case study I can share where a woman was trained with agricultural works to be conducted and other small livelihoods, therefore, when she survives with her own livelihoods, she was so confident, so empowered that she changed her and surrounding's lives by providing training to other women in the village. When her 10-year old daughter was about to go for marriage as child marriage by her husband, she opposed and involved the local administration against the child marriage. Not only that, she changed the child marriage practice there.

So empowerment or gender issue whatever you call it, talking about climate change, all are social issue in those areas. But all these are enhanced by the political issues there. So, my recommendation would be make policy for those who are much more impacted by climate change than others in the real field, then all these social or gender issues would disappear automatically. Thank you

Chair: Thank you very much. Everybody is empowered and charged after the lunch when listening to you. You did a good job. Now may I request Prof. Dr. Umme Kulsum Navera to make her presentation.

Prof. Dr. Umme Kulsum Navera, Department of Water Resources Engineering, BUET

Thank you for inviting me in this seminar in this session here, but first I want to apologize that I am not a gender expert, I work in water sector. So, I will not specifically gender related, but issues related to water issues either male or female, don't matter especially, floods, erosion and related sufferings. I will emphasize what are the sufferings of women in the communities from my experience. After hearing Dr. Dwijen's presentation, I would summarize the issues behind the situation. Because behind all the issues, water scarcity is the main issue which is to be addressed first. Before that, my first observation is that HI-AWARE's study area is Teesta basin, so, will it be good to represent the findings of Teesta basin for the whole country for the gender issue? There should be an indication that this findings from Teesta basin, so that people don't be confused of matters discussed.

Whenever we look into the policy issues, we need to be very specific because different type of floods need different policy implications. For example, flash flood needs the one type of policy, for riverine floods it needs to be different. For sand casting due to floods, it needs another kind of policy implication. So, I would like to know what type of flood, where and how long the areas are inundated. Then we can decide which areas need which adaptation. Otherwise it is difficult for the government to go for a specific adaptation.

Other example may be like this, in Khulna, people are drinking saline water and they are not complaining about it. They are saying that this saline water is okay for them, no problem. But when a pregnant woman drink saline water it creates problem because for a child should drink water below 0.6 ppt salinity level. So, we need to follow a standard. We cannot say that this is okay. So, this is the equity, not gender but human equity what is needed for the specific areas of Bangladesh where people are exposed to the climatic factors. Thank you so much

Chair: Thank you very much. Our honorable Chief Guest Barrister Anisul Islam Mahmud is already with us. We have 1 minute for taking 2 comments from the audience.

Q-A session:

Dr. Syed: I have two comments. One comment is on the thing she (Prof. Navera) was talking about, would like to answer about the health issues. I would like to share from my experience in coastal areas in Cox's Bazar and

surroundings. Prolapse issue is a major health issue of women there, ladies never talk about this. And there are a number of divorce cases because of this, but no health care service exists there for this.

About CFRH, it goes to Teesta because of hotspot level of river basins where Brahmaputra was taken and Teesta as a sub-catchment of Brahmaputra was taken in HI-AWARE research. Another consortium is DECCMA which works in delta region of Bangladesh.

Chair: Thank you very much. Is there any hand for asking questions to the panelists? No, ok. I think your question is already answered by Dr. Syed. I also would like to answer your question of why the research area is in Teesta and in coastal area. In the study of migration in DECCMA, we found 21 types of autonomous adaptations were documented where migration was one of them. First is taking loan. It is problem of policy to decentralize the large cities by developing the secondary cities for accommodating more people by migration from other areas. It is the right of people to participate in the development process of the country. They also need to take part in the development of the country. If you point out the different issues and potential solutions for each community then you will see what will be necessary for the policy makers. I am now concluding the session and thanking the people who give me the opportunity to chair this session. I also thank my distinguished panelists. Thank you

Dr. Atiq Rahman: Thank you very much Dr. Tazneem Siddiqui for chairing the session. We are delighted to welcoming our friend and minister Chief Guest Barrister Anisul Islam Mahmud and he will be joining in the last session of today. The last session will be short presentation of each of the sessions to let him understand what sorts of discussion we get. But now the session will be chaired by Prof. Dr Imtiaz Ahmed of Dhaka University with discussant Dr. Golam Rasul Chief Economist of ICIMOD and Khandaker Mainuddin, Director of BCAS. I think two of them would be enough.

They will discuss on climate change impacts on water at river basins: upstream-downstream linkages. The basic problem here is snowmelt increasing. I said in the morning that 12000 new lakes have been formed out of 1200 glacial lakes over the last decade. While a glacial lake takes centuries or millennium to form it. But this happened rapidly. Because it was enhanced by the glacial melting in the upstream. As a consequence, glacial lake outburst floods increased, sedimentation increased, consequently destabilization of the rivers in the region. Therefore, there is a linkage between upstream and downstream of the large rivers remaining a critical issue of the region. Over to you Prof. Dr. Imtiaz Ahmed.

3. Panel Discussion

Climate Change Impacts on Water at River Basins: Upstream-downstream linkages

Chair: Prof. Dr. Imtiaz Ahmed, Department of International Relation, Dhaka University, Bangladesh

Chair: Thank you very much. I would go directly to the topic. We will hear the two discussants first. Then I will preserve 5-6 minutes for me for concluding statement on the discussed issues. Let me first invite my friend Dr. Golam Rasul for his speech for 7 minutes.

Discussion points

- Upstream and downstream in river basin in HKH region particularly in Teesta-challenges and opportunities;
- Addressing climate change impacts on water resources at basin/sub-basin level; and
- Basin level river management for enhancing resilience of ecosystems and livelihoods.



Panelists:

Dr. Golam Rasul, Chief Economist, ICIMOD

Thank you Imtiaz bhai. I am delighted to see our Chief Guest, although he is the Minister of the ministry of environment, forest and climate change, he is just recent past minister of the ministry of water resources and in the long past he was the minister of the ministry of foreign affairs. So, we are conveying our message to a 3 different ministries at a moment.

Here we will see two things are changing due to climate change: water and rivers. You all know that water is found 3 forms, solid, liquid and vapor. Water is found in 3 solid forms too: snow, glacier and ice, all three forms cryosphere. And this cryosphere has an important role in river function level as well as ecosystem services provider. The great question would be how would be the impact of climate change on these three forms of solid water. 1.5 degree global warming 33% of cryosphere would disappear and 2 degree will decline 49% of cryosphere. We from downstream people are dependent on upstream impacts on water availability and that is big issue. So, what happens in upstream of Nepal, India, Bhutan and China, affects us in the dry season water availability as well as flooding situation in monsoon. We cannot plan without the upstream water availability in the rivers. In the dry season when we need water for irrigation, what will happen if 33 - 50% of glaciers disappear.

At the present conditions, till 2040 the dry season flow will increase due to glacier melting, but what would be the situation when glaciers melt totally. Many people suggest to develop storing monsoon water for hydro power in Nepal what would increase the dry season flow in the rivers. But the impact of storing huge amount of water in

the mountain would further increase the risk of earth quack. We should be very careful of taking the large project interventions in future. So, this upstream-downstream linkage needs regional cooperation and this is very important of Bangladesh as an upstream dependent country.

Recently our energy minister went to Nepal for collaboration between two countries for energy sufficiency of both countries where Bangladesh will get additional hydropower generated in Nepal, and Nepal will get energy during dry season from Bangladesh when hydropower will not be operable. Moreover, such large hydropower projects will augment the dry season water flow in the rivers which is very required for downstream countries. This is a very example of regional collaboration if it can be implemented. Discussion is also going on under BBIN (Bangladesh-Bhutan-India-Nepal) initiative on collaborating motorized movement and inland navigation between the countries, while Nepal and Bhutan are pushing India for using Bangladeshi sea ports themselves.

This is the time collaborate in such large issues like climate change and for economic development so that we can survive in future against the climate and environmental issues. Thank you very much for giving me the opportunity.

Chair: Thank you very much. Now I would invite Mr. Khandaker Mainuddin of BCAS for his speech.

Khandaker Mainuddin, Director BCAS

Today there are three issues: climate change impact, adaptations and gender responsive inclusion. Climate change impacts are controversial because people don't believe the climate change impact assessments as these are not based on adequate scientific evidences. Development may be the proper adaptations for the communities. We have to develop in a total way not only increasing the GDP but also the welfare of the poor vulnerable communities. If we can accommodate the total development, gender responsive issues will also be achieved.

About the climate change models mostly are produced by the developed countries. We developing countries are only following these models. But these models have the inherent problem of uncertainties. Most models forecast the average temperature will increase by 5 degree in next one hundred years, but what would be the seasonal variability would be very important for our economic growth which may lead to disasters too. So, to make the models certain we need real and accurate data collection from the fields. I will emphasize on that we should start collecting data by monitoring network of different types of data on natural resources of water, soil, forest, land and so on. And the government would take the initiative to collect these data where researchers will get privileges/ free access to the database.

I would also appreciate to inter-country collaboration on collecting and sharing data with equitable share and equitable resources which are common resources. On the other hand development has its own side effects. It is based on mainly capitalism, and consumerism. But equity would be achieved if we take more and more adaptations for the vulnerable people. We also need to see our past on which we are based on. Because more importantly consumerism would replenish our natural resources, so we need to be very careful, if all resources replenished what we will do at the end.

I would like to end my speech by mentioning one true story. Once a boat rider asked to the boat driver, do you know how the moon fluctuates in different times? The driver replied NO. The rider told that your life is 25% of no value. Then he asked again do you know how the high tide is created by the moon fluctuation? He again replied NO. The rider again told that his life is of 50% no value. After a while, the sky remained black with full of clouds and thunderstorm. Then the boatman asked the man can you swim? He replied NO. Then your whole life is in risk and will be of no value. That is the past knowledge to be prepared for any sudden event. Therefore, we also need to know what to do at the right time at the right place. Thank you very much

Chair: Thank you Mr. Mainuddin. Both presenters are very good in keeping their time. Normally we the old persons talk for hours. Now the floor is open to all, who wants to go first? Any question you want to raise. I am not pushing you, NO, ok. I will take a few minutes and close the session.

We need a serious paradigm shift particularly in Bangladesh. Bangladesh is a land of rivers, not a place of land only, a kind of water kingdom, not a land kingdom. In science we learn water as H₂O, but in social science water is H₂OP₄ that also includes pollution, power, politics, and profit. Now we translate the word 'river' into Bengali as 'Nadi'. But they are not of the same meaning ethnologically. English 'river' word comes from the word 'riberia' or 'riveria' or similar words which mean where water arrives, it's actually the banks, not the water. Now Nadi is a very old concept in Sangskrit. Nadi in the Brihadaranyaka Upanishad is described as inclusive of three things: pran (life), atta (soul), and shakti (power). In another meaning, Nadi is called as an abbreviation of WEBS which means W for water, E for energy, B for biodiversity and S for sediment. Last year we have seen that Bihar was affected by a large flood. Therefore, each river should have these three or four things and we need to re-conceptualize the meaning of river where all these four things should be shared with the area where the river flows.

Now let us know how we can solve a problem. There are two big theories when there are big changes in a country: theory of scarcity and theory of surplus. We always love to talk about theory of scarcity. 5% people have the most surplus wealth, while others are in scarcity. However, if you want to make difference in the situation, you need to start working the surplus, not the scarcity. Now when you start with scarcity and afraid, you cannot go very far. The reason behind this according to economists is that scarcity cannot solve any problem only the surplus can do it like trade of goods. You cannot trade with people who don't have the purchasing power. You need to start working with the surplus. You know why the European Union succeeded especially for France and Germany, they started working with the surplus applying theory of surplus. After the second world war, they started thinking what thing we have more or surplus, they found steel and gold. China also used this theory. China found that they have more people, so they started making skilled manpower developing by education, technology, etc. Now they are a power.

Now the question is what about South Asia, or what about Bangladesh. I would like to mention the national professor of Bangladesh Prof. Abdur Razzak. Two things are to be known to everybody. Two things are water and people. We invested on people and send them to other countries. Now we are getting remittances. But we are yet to invest on water. We have surplus water during monsoon which can be useful for dry season, how, you the planners will decide.

I have read in a published scientific article that 80% of Brahmaputra's total flows are coming from the rainfall outside the country. I published an article in a newspaper Samakal long time back of which the title was 'gold drops are falling from the sky' or something like that. So, we don't do anything with 80% just we let it go to the Bay of Bengal. Now the time to think what we can do with this 80%. To end the story here, to resolve the issues of climate change and water and collaboration among countries in South Asia how to solve the issues. Therefore, we need to emphasize on the water/river, and the two theories. We need to focus on surplus.

We see that our newspaper too, they focus so much on scarcity including accidents without knowing that the number of accidents in New York is much more than in Bangladesh. I would like to end the thing by mentioning one thing. In New York and Washington DC, rape is a major problem, in each two minutes there is a rape. But the New York Times or Washington Post doesn't publish this news, they handle it in another way. Because once you keep on repeating the same story, you will become used to it. It will not strike you anymore. You look at the picture, and say oh no. And that is the worst thing to resolve the problem. It is not the way to resolve the issue by only publishing the news in the newspaper. So, I am telling the people, one has to reinvent the thing in a new way.

In recent days, you have seen our print media was lost out, they could not even think of our 'Shishu Biplob'. But you have seen that how this technology of making awareness has really made the big difference. I am not hitting anybody. I am trying to be optimistic to inform you about this how it worked. We have to invent the way how we can solve a real world problem. Only with the knowledge of the text book one cannot go very far. We need a different kind of understanding. I would say about the idle money we have at the state which can be used for solving this kind of problem and we would be in a better position. Thank you very much



Closing session

Chair: Dr. Atiq Rahman, Executive Director, BCAS

Good afternoon. In deed it is a great pleasure to have our Chief Guest Mr Barrister Anisul Islam Mahmud, let's call him Anis bhai. He told me could I come in the afternoon. In the afternoon session after a heavy lunch, many of you are lousy. But you will be energized very soon to listen Anis bhai who has really work in the real field of water distribution in South Asia first hand. But before that you will get a glimpse or short summary of today's discussions and our research project HI-AWARE which is one the four consortia working in three hotspots around Africa and Asia under CARIIA. Out of these four consortia, one is based in solely in South Asia which is HI-AWARE research. Four years, five institutions along with six others, we came to a close after publishing many journal articles, and many of them are in pipeline to be published (under review) in which many new knowledge have been generated which we can use for our betterment in future. Our another partner in BUET, they also worked in DECCMA another of four consortia in generating new knowledge in southern coastal region in Bangladesh. So there are many stories.

Today we are here for understanding high land low land interactions and the consequence of climate change on this issue. We are talking about 1 or 1.5 or 2 degree increase, but it is not the full story at all. We are already at 0.9 degree increased position. The way western world is behaving now, if it goes like this, the temperature will go 3.7 degree increase at the end. And we don't know yet what will be the consequence for the glaciers and downstream areas what will be the actual situation. Today from the morning we have done four technical sessions where a lot of thing already discussed. I am not going to the details but request Dr. Abu Syed to give us a glimpse of what was discussed in today's sessions just to wake up the people or to summarize the things. Over to Dr. Abu Syed

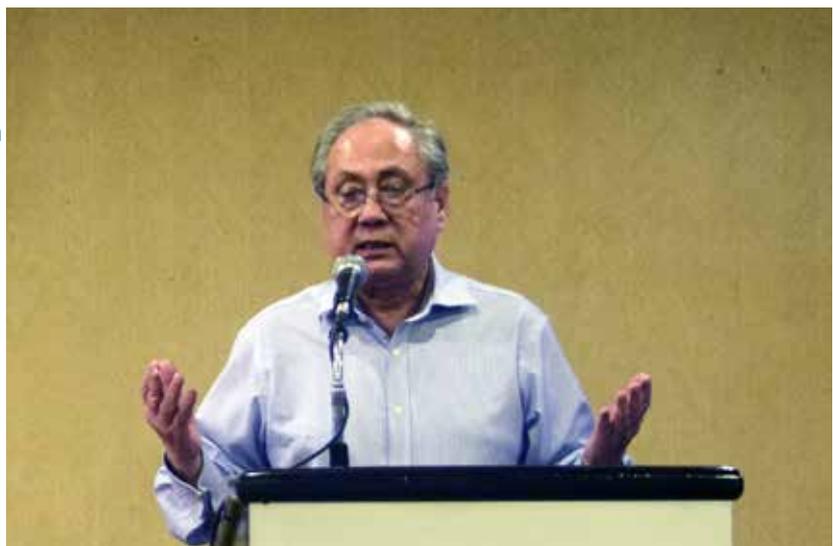
Dr. Abu Syed: Thank you chair. It is very challenging for me to summarize all the things discussed from the morning today. But I will give a summary only to our Chief Guest so that he can understand what was discussed.

Chair: All the database is very useful for us. Now the honorable Chief Guest, he has a long experience in this field. I would like to hand over the mike to you for your valuable speech to us.

Chief Guest: Barrister Anisul Islam Mahmud, Minister, Ministry of Environment, Forest, and Climate Change, Government of Bangladesh

Good afternoon. The subject matter is climate change adaptations in the river basins: upstream downstream linkages. After coming here I remained silent and enjoyed the discussion went in different sessions I have seen in an interactive deliberation.

Only yesterday BDP2100 has been approved which considers the climate change issues for the future possible impacts in different sectors. We have at least 5 hotspots in this small Bangladesh which need different treatment for each of them. I don't know any other country which has problems in all the areas of that country. Climate change is a global issue which results in sea level rise in the coastal areas and many other disasters. It is very alarming that 20% of our total land would go inundated due to sea level rise at the end of this century. Cyclones are less dangerous that the problem of erosion. Because now we have more resilience than before in terms of cyclone and storm surge management and adaptation measures taken into consideration. Now the casualties and asset loss



have decreased because we have prepared for those in advance. But every year we lose 5000 ha of land due to riverbank erosion where many people go poor. Because of this a number of migration is taking place. But people get strength to combat against the extreme event. Now coming back to climate change, migration was also in previous as erosion was there, flood was there. But now what is the direct impact of climate change that should be identified first. Otherwise it would be difficult to address that. I personally believe that there are direct impacts of climate change. Because I see only recently if you go through the road from Chittagong city to the airport, Patenga road is submerged by high tide which never happened before. I request the researchers please create a database now to study in future what would be 10-20 years later the impacts.

To combat against the climate change issues, we need to work from now. For example, increasing the height of polders due to sea level rise of 0.8 m at the end of 2100. But there is controversy of polder system. Water management is very complex because it integrates all the things together and you have to satisfy everybody to that system. In Netherlands, Schiphol airport is 5 m below sea level. They had floods of more than one thousand years. How they implemented it? After the devastating 1953 flood, they made it themselves. We need to think about the situation seriously for any intervention, what would be the environmental impact of that intervention. I know Satlabad in Barisal, when the polder was made, it changed their lives. People are so happy there now. There was no communication in previous. They could not go for any cultivation. Now they are resilient in livelihoods. But many people criticize this polder system. In Bangladesh, Dhaka-Narayanganj-Demra (DND) embankment is not working anymore, why? Because it was not studied well what will be the impact of that intervention in future. Today, people are against the sluice gates. They are not working properly, because of lack of proper maintenance. But when it was designed, that was the latest technology we had. Today after 60 years you are saying that the design was not good. But if it can work in other areas, why not in Bangladesh. Therefore, we need to think what would be needed and would be sustainable in future. But it is very challenging because our river system is very large and of which 97% catchment area is out of our country we have no control on it. Ganges-Brahmaputra-Meghna river system is the 2nd largest system in the world after the Amazon. Amazon is in Brazil. But Brazil is a big country which has the control of its most upstream catchment. But Bangladesh is a very small country with large river system on which it has no control. So how we can solve the problems? Fortunately we have now the DBP2100 in which Ganges barrage is the top priority in it. I personally believe that without this project the fate of one third of Bangladesh i.e., the southwestern region of Bangladesh is going in danger. Because unless we don't push fresh water from the north, we cannot get rid of saline water in that region which is gradually increasing affecting ecological balance as well as livelihoods and living condition of people.

So, there should be investment in agricultural research in future for sustainable Bangladesh. Because climate change will affect the timing of rainfall, short period of time and so on which affect tremendously our agriculture system. So there should be lot of investment on how to adapt our agriculture system with the changing climatic condition. I am really grateful to Atiq for calling me here. Other issue I want to mention is gender issue. The type of gender issue what I see here due to climate change impacts, is not like that. There is already gender issue, or we cannot ignore that issue too. We need to have a better policy on it.

Thanks you very much.

Chair: Okay. Ladies and gentlemen you had a long day hearing the policy making issues, some from the head, some from the heart. But we had a very good day. Thank you very much for the patience you have shown. Our tea is outside there. I would request our all participants to join in the tea. I would like to conclude the session here. Thank you very much for hearing us for the whole day.



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