Seventh Framework Programme

Theme 6

Environment

Project: 603864 – HELIX

Full project title:

High-**E**nd c**L**imate **I**mpacts and e**X**tremes

Deliverable: 9.1

Stakeholder workshop: South Asia

Version 1.0

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Contents

Stakeholder Workshop Regional Focus: South Asia - Delhi, India

Background Note

The High-End cLimate Impacts and eXtremes (HELIX), is a European Union Collaborative project started in November 2013, with sixteen participating institutions lead by the Exeter University, UK.

The rate of future change will be a critical factor in the vulnerability or resilience of societies to the changing climate, because ongoing economic development will affect the sensitivity of societies to weather and climate, and adaptation measures will require time to be identified, planned and implemented. Interdependencies between different impacts, both biophysical and socio-economic, shall make the problem even more complex.

HELIX shall address this situation by providing a clear, coherent, internally-consistent view of a small, manageable number of "future worlds" under higher levels of global warming reached under a range of physical and socio-economic circumstances, including consideration of different adaptation scenarios, supported by advice on which aspects are more certain and which less certain. This will be delivered through groundbreaking scientific research across a range of physical, natural and social science disciplines, in close engagement with experienced users of climate change information to ensure appropriate focus, clarity and utility. Both the research and the engagement with users will consider a range of scales from global to local, with internal consistency across the scales being a priority.

Our research shall focus on addressing the questions "What do 4ºC and 6ºC worlds look like in comparison to 2ºC?" and "What are the consequences of different adaptation choices?" The core of HELIX work will be at the global scale, but there will be an additional focus on three key regions (Europe, northern sub-Saharan Africa, and Indian sub-continent).

HELIX will assist decision-makers in making the climate adaptation problem more tractable, by providing a manageable set of credible, coherent, global and regional views of different worlds at 4ºC, 6ºC and 2ºC, capturing levels of certainty in a clear and transparent manner. Climate change simulations at 2ºC, 4ºC and 6ºC shall be generated with high resolution GCMs which have been shown to produce improved representations of weather extremes, and use these to drive specialist hydrological models to assess the impacts on drought and flooding. The new simulations of climate extremes and biophysical impacts will be used for new global socio-economic assessments, examining economic-wide implications of climate change and identifying time- and path-dependencies of different adaptation options.

The RCM-based assessments shall be made in 3 focus regions (Europe, East Africa, Indian sub-continent). Within all these work areas, potential tipping points in any of the physical-biogeochemical Earth System, natural ecosystem responses and/or socio-economic responses will be systematically assessed. Delivered through a bespoke visualization tool, the final product will be a set of quantitative scenarios supported by a confidence assessment, which can be used by decision-makers to inform scenario planning of different adaptation and mitigation pathways.

The present stakeholder workshop is intended to engage with the potential stakeholders to discuss with them their expectations from such an exercise.

Event Inauguration

Workshop was organized by Indian Institute of Technology, Delhi on 13th August, 2014 as per the programme appended on Page 12.

Dr. Amarjeet Singh, IAS, Additional Secretary MoWR, Govt. of India was the chief guest for the inaugural session. Prof. Gosain welcomed the participants and bouquets were presented to the chief guest and other dignitaries. This was followed with a short round of introductions made by each of the participants. Annexure I provide a complete list of participants and Annexure II present a compilation of short biographies of most of the participants.

In his inaugural speech, Dr. Amarjeet Singh emphasized that it is important to have inclusive and sustainable development. He further emphasized that even the past historical records on some of the crucial parameters are showing definite trend. Considering the past 100 years of rainfall data has shown that there are overall 16% deficit years, however the last 30 years show 26% rainfall deficit years. This may be attributed to climate change. He further said that climate change is expected to affect almost 25% of the irrigated area in south Asia and India. Climate change will also be of critical importance to 6400 km coastal area of India. Local level climate change impact assessment is crucial with emphasis on water quantity, quality, and glaciology. He was of the view that HELIX outputs will be important considering the above aspects to better prepare and protect people. In his view assessment of vulnerability, biophysical impact on ecosystem, hazard risk, socio economic impact (through energy water and food impact), human health (Ebola, Malaria), migration and resultant conflicts are some of the issues that need immediate attention.

Workshop Proceedings

The next session of the workshop was structured to have the following presentations

- Overview of HELIX project
- Scope of HELIX in South Asia
- Experiences from UK Stakeholder workshop

Presentations

Prof. Richard Betts made the first presentation to introduce HELIX project to the participants. He provided an overview of the project covering the major objectives set out for the project, duration (4 years), project partners (17 with Lead from Exeter, UK), project sites identified (Europe, Senegal, Ethiopia, India, Bangladesh) and project products (climate change impact assessment under scenarios with temperature greater than global average >2 deg C: 2^0, 4^0, 6^0 C).

The next presentation was made by **Prof. A.K. Gosain** who covered the scope of work to be taken up under Package 9, with focus on South Asia. Scope of this package includes:

- Stakeholder engagement (Task CCT1c.1 (9.1))
- Impacts and vulnerability with existing techniques (SMHI, all) (Task CCT1c.2 (9.2))
- Uncertainty analysis (Task CCT1c.3 (9.3))
- Improving impacts models (Task CCT1c.4. (9.4))
- Adaptation assessment using new impacts projections (UNEXE, all) (Task CCT1c.5 (9.5))

He further explained that the first step towards achieving the scope was to hold stakeholder workshop with the following objectives, which is being conducted today

- Need Assessment (with participants from Government departments, policy makers, NGOs)
- Development of Standardized (semi-structured) workshop protocols to facilitate cross-workshop comparisons
- Deliverable: a report based on the outcomes of the stakeholder workshops, including the main lessons and recommendations for research design
- Dissemination of results: It may be through a small communication in local language, and/or by use of social media (the project Twitter feed, website and Facebook page)

He also shared information on some of the web based dissemination products that IIT Delhi has developed in the past. He also conveyed the synergies with some of the ongoing projects at IIT Delhi.

Asher Minns shared with the participants the outcome of the recently held European stakeholders workshop. Range of stakeholders that participated in the European workshop at Exeter include UN, migration organisation, climate experts (met office), scientists, people from business organisation (Insurance), participants of sister project (Impressions, Rises/sea level rise). The major take home learnings from the workshop were

- Indirect impacts are as important as direct impacts
- Not sectoral, but the decision points of impacted sectors (Linkages between sectors, not direct impacts as individual sectors) are important
- Stakeholders are interested in scenarios, timeline and Decision Points
- Moving base lines (not traditional 1990) are preferred

- Consistency in scenario for enabling mix and match as well as performing comparisons is preferable.

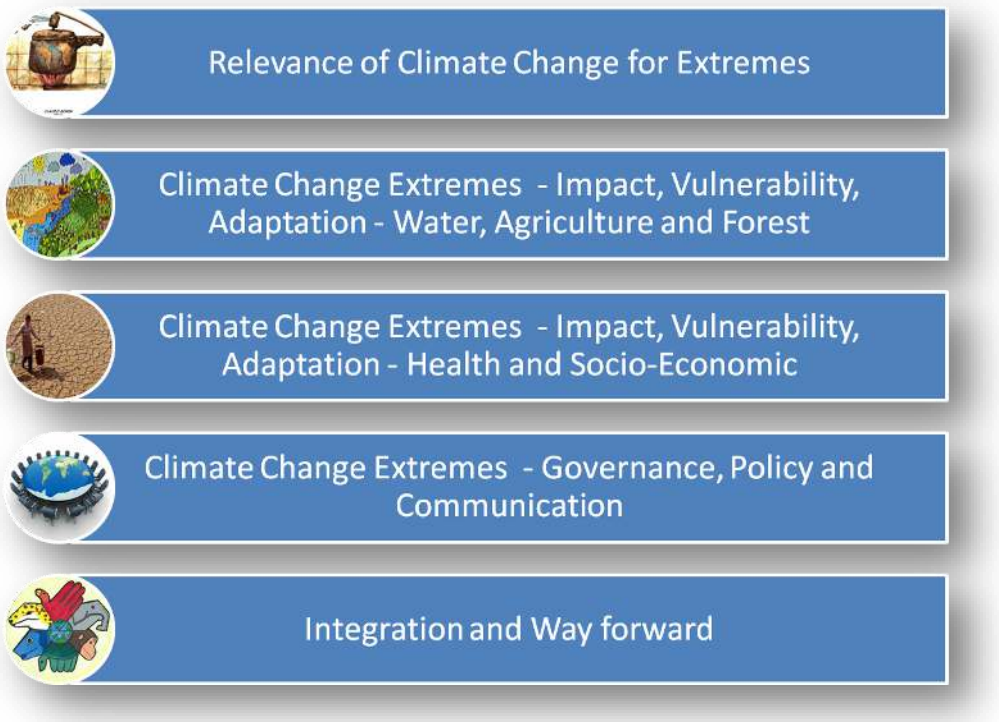
He further emphasized that there is bound to be difference in the perception of UK high level Climate knowledgeable stake holders and that of Senegal (more farmers, small groups) stakeholders.

Panel Discussions

Dr Sandhya Rao at the outset made a brief presentation setting out the format of the five panel discussions set out for the day. She explained that the structure that shall be followed for each of the panel discussions was:

- Opening remarks by each panellist 5 minutes each (Panel Time: 25 minutes)
- Open discussion – 25 minutes with Short and targeted questions/comments/observations

The following five panels (see figure below) were identified to focus the discussion on range of aspects.



Panel Discussion 1 - Relevance of Climate Change for Extremes

Panelists

- Dr. Akhilesh Gupta - DST - Chair
- Dr. K. J. Ramesh - MoES
- Dr. A. P. Dimri – JNU
- Dr. Vimal Mishra – IITGN
- Mr. Siddharthan - GGGI

Dr. Akhilesh Gupta, Adviser & Head, Strategic Programmes, Large Initiatives and Coordinated Action Enabler (SPLICE) and Climate Change Programme, Department of Science & Technology, highlighted that greater than 2^0 C has relevance in mitigation since for sustainable and robust adaptation scenarios

2, 4, 6 are more relevant. Top down policy measures need to be taken to address adaptation. He said that India is fortunate in having less extreme weather conditions compared to other South Asian countries. He also shared that DST is spearheading 2 missions – National Mission on Strategic Knowledge for Climate Change and NMSHE (National Mission for Sustaining the Himalayan Ecosystem) with academic and national research institutions, which will help reduce duplicity of efforts. He also emphasized on the issue of capacity building for development of high resolution climate models in collaboration with European countries with special focus on smaller spatial regions – district/sub district level and on extremes.

Panel Discussion 1 - Summary

Although, currently there is good advancement in instrumentation and observational network, there was a general consensus that improvement in observations and predictions are required. Therefore the models need considerable improvement for making improved predictions on monsoon system of Asia.

The user requirements of this session can be summarized as:

- Higher resolution data (at districts and block level)
- Availability of long term observational time series data
- Need to redefine extremes (both floods and droughts) relevant to different sites
- Consideration of rainfall distribution and frequency is important for extreme event and therefore attempts should be made to make such data available
- There is an immediate need for institutional and human capacity building
- Gap area identification should be taken up for all the concerned organizations and long term support should be provided by the government
- Attempts should be made to create awareness through various modes of communication
- Climate smart services should be created on the pattern of Insurance sector.

It was suggested that a detailed workshop is required to discuss the sectoral impacts due to extreme climate.

Panel Discussion 2 - Climate Change Extremes - Impact, Vulnerability, Adaptation - Water, Agriculture and Forest

Panelists

- Mr. A.B. Pandya – CWC - Chair
- Prof. N.H. Ravindranath – IISc. Bangalore
- Dr. Soora Naresh Kumar – IARI
- Dr. Bharat Sharma - IWMI

Mr. A.B. Pandya, Chairman, Central Water Commission, opened the discussion with a remark that all the sectoral people are the potential consumers of the HELIX like climate products for making impact assessment on their respective sectors. He also emphasized that water is an integrator that binds all the sectors. Since adaptation in water sector is a very basic requirement that is considered at the time of implementation of projects it is important and critical to look into vulnerability assessment and adaptation needs as well for these projects.

Panel Discussion 2 - Summary

The first part of discussion revolved around the fact that Monsoon being a typical character of South Asia must be understood and characterized properly.

Long term planning is needed to address the changes in precipitation and temperature. Spatial and temporal scales are very critical and should be addressed appropriately. Usually, issues at local scale need to be handled with short-term temporal scale. Thus climate models need to generate projections that can help implementing adaptations at the local scale. If we downscale below that, local randomness will overtake. Science may not be able address high-resolution spatial scale requirement in the near future, therefore there is a need to identify meaningful spatial size for down scaling and adaptation. Anecdotal evidence needs to be put into systematic assessment. Science should feed to policy mechanism, and even with uncertainties some difference shall be made through simulation modeling.

Discussion ended with a suggestion to have an integrated ecosystem and landscape model that can be used to create a user-friendly accessibility to Helix outputs.

Panel Discussion 3 - Climate Change Extremes - Impact, Vulnerability, Adaptation - Health and Socio-Economic

Panelists

- Mr. Manavalan - AFPRO - Chair
- Dr. Sumana Bhattacharya - IC
- Dr. R.C. Dhiman - MRI
- Dr. Mahesh Rajasekar – Taru Leading Edge
- Mr. Anand Kumar – Development Alternatives

Mr. Manavalan, Executive Director, AFPRO opened the discussion emphasizing that there is a need for inclusive growth. He further emphasized that gender and socio economic issues, health with special mention of nutrition, health of both flora and fauna (live stock) need to be considered while looking at the impacts of climate change. Need for documenting traditional adaptation practices was also highlighted.

Disease pattern (vector borne, heat related) shows that more events have occurred in last 30 years as compared to last 100 years, thereby indicating high frequency of such events. These may be result of combination of factors including Infrastructure combined with climate change.

Panel Discussion 3 - Summary

Following points were brought out

- What is the relevance of 2/4/6 deg global temperature on regional scenario
- Predictive health models, mapping wrt climate change, development of early warning systems are some of the priority areas
- Socioeconomic aspects and climate change implications need to be integrated
- Risk management is essential to be undertaken and the first step in the direction can be production of risk maps
- Blend formal and informal science for better communication
- Indulge in detailed working with community.

Discussion ended with a suggestion to have health models. Need for HELIX bouquet of scenarios (currently do not have 2/4/6 deg scenarios) and tools to assess the uncertainty range. It was also felt that skin diseases and other flood and saline intrusion related health impacts should also be included and studied.

Panel Discussion 4 - Climate Change Extremes - Governance, Policy and Communication

Panelists

- Dr. Bill Young – World Bank - Chair
- Dr. Brij Gopal - JNU
- Mr. Ashok Kharya - CWC
- Ms. Aditi Kapoor – Future Alternatives
- Mr. Lokendra Thakkar – EPCO, MP

Dr. Bill Young, World Bank, opened the discussion emphasizing that there is a strong need for meaningful communication on climate change with proper contextual information. Looking climate change impacts with lens of global change is needed. Different aspects of climate change actions addressed at international to local level governance and policy with International (mitigation), National (intermediate change) and Local (adaptation) need to be understood. All synergies and scenarios need to be considered for better and robust planning.

Panel Discussion 4 - Summary

Following points were brought out

- Integrating programs is the need of the day
- Over doing of local actions may be harmful if proper trade-offs not arrived at
- Put the scientific information in public domain which is integrated and user friendly
- Challenge is to convince policy makers (since it is rather difficult for Knowledge brokers to convince policy makers/decision makers)
- Bottom up planning in India does not account for Climate Change
- It is important to break barrier between transboundary neighbours
- It is required to bring research into the context for national to local adaptation
- Cost of adaptation may have more advantage if impacts are planned through HELIX like outputs.

Discussion ended with an emphasis that concrete evidence supported by studies to change and modify the existing guidelines though HELIX will be a good contribution accompanied by uncertainty analysis. Inclusion of practitioners and policy makers in HELIX stakeholder workshop was also well appreciated.

Panel Discussion 5 - Integration and Way forward

Issues related to integration and linkages between impacts, scale and timelines were discussed in this last session.

Panelists:

- Prof. Richard Betts - Chair
- Prof. A.K. Gosain
- Mr. Asher Minns

- Prof. A.K.M. Saiful Islam

Prof. Betts explained that the HELIX project is into its first year. Second half of the 4 year project would have all the stakeholder's concerns and requirements included in the research design to be performed in the second year of the project. The 2/4/6/ deg will be driven by CMIP5 scenario. There will be a new Hadley centre model.

Midterm workshop shall be conducted and executive summary published. Policy briefs shall be brought out in local languages. A special workshop on how to deal with the outcome of unwelcome messages because of extreme events would be conducted.

Workshop Summary

HELIX South Asia Stakeholders Workshop – Delhi, was organized on August 13, 2014 by Indian Institute of Technology, Delhi. The workshop was well attended (61 participants) and the participants spanned from government officials, academicians, NGOs, donors and Private sector people. Expertise amongst the participants ranged from Climate scientists, Impact modelers, Vulnerability and adaptation experts to Health experts. Sectorial representation included climate, water, agriculture, forest, energy, health, socio-economic, policy and governance. Inaugural address was delivered by Dr. Amarjeet Singh, IAS, Additional Secretary, MoWR, who emphasized on inclusive development, importance of local level impact assessment with special attention on water quantity, quality and glaciology at river basin scale. He reiterated that HELIX outputs would be important considering the above aspects to better prepare and protect people.

Initial presentations covered the overview of Helix project followed with a brief presentation on outcome of stakeholders engagements in Europe. Intent and scope of the present South Asia Stakeholders workshop was presented next. The stage was set with the last presentation describing the format and scope of the panel discussions set up for the day.

This was followed by panel discussions. Five panel discussions focusing on (1) Relevance of climate change for extremes, (2) Climate change extremes – impact, vulnerability and adaptation on Water, Agriculture and Forest, (3) Climate change extremes – impact, vulnerability and adaptation on Health and Socio-economic, (4) Climate change extremes – governance, policy and communication and (5) Integration and way forward. Each session had 4 to 5 panelists who shared their knowledge and expertise followed by a general discussion by the participants. The session time was equally divided among the Panel and participants to allow maximum participation.

Following is the set of recommendations that emerged from various sessions

- Higher resolution data (at districts and block level)
- Availability of long term observational time series data
- Need to redefine extremes (both floods and droughts) relevant to different sites
- Consideration of rainfall distribution and frequency is important for extreme event and therefore attempts should be made to make such data available
- There is an immediate need for institutional and human capacity building
- Gap area identification should be taken up for all the concerned organizations and long term support should be provided by the government
- Attempts should be made to create awareness through various modes of communication
- Climate smart services should be created on the pattern of Insurance sector.
- Need for identifying meaningful spatial down scalable size
- Documentation of anecdotal evidence which feed into systematic assessment
- Science should feed to policy mechanism, and even with uncertainties some difference can be made with modelling.
- Need to have an Integrated ecosystem – landscape model
- Create user friendly accessibility to Helix outputs.
- What is the relevance of 2/4/6 deg global temperature on regional scenario
- Predictive health models, mapping wrt climate change, development of early warning systems are some of the priority areas

- Socioeconomic aspects and climate change implications need to be integrated
- Risk management is essential to be undertaken and the first step in the direction can be production of risk maps
- Differentiation in terms of urban and rural space should be done since urban space usually has higher impact than rural areas
- Formulate climate smart programs to connect, communicate and collaborate
- Blend formal and informal science for better communication
- Integrating programs is the need of the day
- Over doing of local actions may be harmful if proper trade-offs not arrived at
- Put the scientific information in public domain which is integrated and user friendly
- Challenge is to convince policy makers (since it is rather difficult for Knowledge brokers to convince policy makers/decision makers)
- Bottom up planning in India does not account for Climate Change
- It is important to break barrier between transboundary neighbours
- It is required to bring research into the context for national to local adaptation
- Cost of adaptation may have more advantage if impacts are planned through HELIX like outputs.

Expert Feedback Analysis

All the participants were provided with the questionnaire/feedback form appended at the end of this document. The feedback provided has been analyzed and made available as Annexure III.

Banner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High End cLimate Impact and eXtremes
IIT Delhi
SEVENTH FRAMEWORK PROGRAMME
HELIX-South Asia Stakeholder Workshop
13th August, 2014, IRD Conference Room, IIT Delhi

High End cLimate Impact and eXtremes

HELIX - South Asia Stakeholder Workshop

DATE: 13TH AUGUST, 2014
VENUE: CONFERENCE ROOM, IRD, 7TH FLOOR, MAIN BUILDING, IIT DELHI, HAUZ KHAS, NEW DELHI – 110016

Programme

Time	Event
09:00-9:30	**Registration**
9:30-10:00	Inauguration by Dr. Amarjeet Singh, IAS, Additional Secretary MoWR, Govt. of India Introduction by the Participants
10:00-10:10	Overview of Helix Project Prof. Richard Betts, University of Exeter
10:10-10:20	Scope of HELIX in South Asia Prof. A.K. Gosain, IIT-Delhi, India
10:20-10:50	**Tea Break**
10:50-11:00	Workshop Objective Dr. Sandhya Rao, Director, INRM
11:00-11:10	Experiences from UK Stakeholder Workshop Mr. Asher Minns, University of East Anglia, UK
11:10-12:00	Relevance of Climate Change for Extremes Panel Discussion Panelists: Dr. Akhilesh K. Gupta, Dr. K. J. Ramesh, Dr. A. P. Dimri, Dr. Vimal Mishra, Mr. Siddharthan
12:00-13:00	Climate Change Extremes - Impact, Vulnerability/Adaptation - Water, Agriculture and Forest Panel Discussion Panelists: Dr. A. B. Pandya, Prof. N.H. Ravindranath, Dr. Soora Naresh Kumar Dr. Bharat Sharma
13:00-14:00	**Lunch Break**
14:00-15:00	Climate Change Extremes - Impact, Vulnerability/Adaptation - Health and Socio-Economic Panel Discussion Panelists: Mr D.K. Manavalan , Dr. Sumana Bhattacharya, Dr. R.C. Dhiman, Dr. Mahesh Rajasekar, Mr. Anand Kumar
15:00-15:55	Climate Change Extremes - Governance, Policy and Communication Panel Discussion Panelists: Dr. Bill Young, Dr. Brij Gopal, Mr. Ashok Kharya, Ms. Aditi Kapoor, Mr. Lokendra Thakkar

15:55-16:15	**Tea Break**
16:15-16:45	Integration and Way forward Prof. A.K. Gosain, Prof. Richard Betts, Mr. Asher Minns, Prof. A.K.M. Saiful Islam
16:45-17:00	**Concluding Session**
19:30	**Workshop Dinner**

Template of Feedback Form

Expert Feed Back

(Please provide your feedback on Extreme Climate[1] Impact, Vulnerability /Adaptation with respect to your domain)

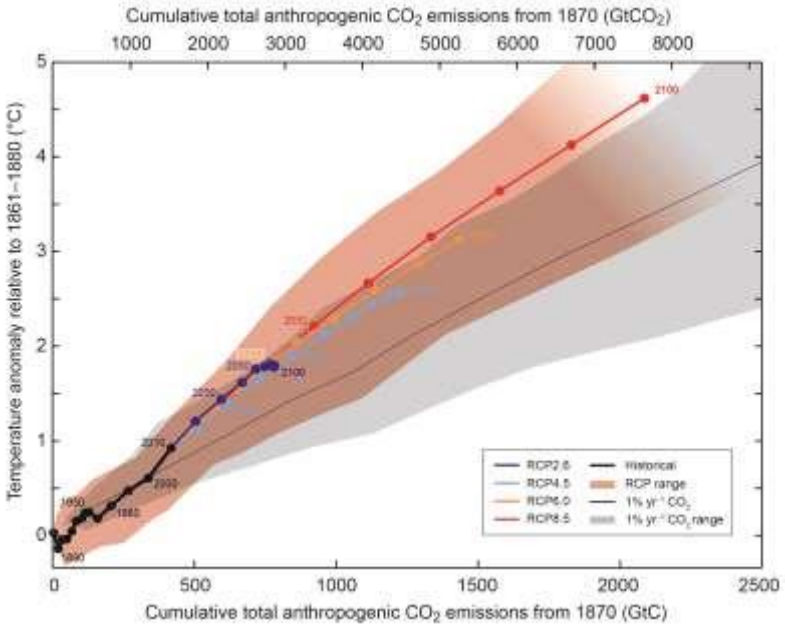
Name/Association/email	
Your Domain of expertise	
What time horizon is relevant to your decision-making (next season, next year, several years, several decades, a century or more)?	
What level(s) of global warming relative to pre-industrial considered in HELIX (2, 4, and 6^0C) are of particular interest to you?	
Kind of information needed from Climate Modelers/Experts *(Parameters, spatial and temporal resolution)*	
Possible conceived Impact/vulnerability	
Possible Adaptation Options *(Adaptation Spatial/district, block, village etc. and Temporal scales/immediate, near or long term)*	
No regret/ win-win Adaption options in spite of uncertainty in Climate projection	
Which are the Inter dependent domains (list)	
How do you expect the communication *(like AR5 confidence/uncertainty)*	

[1] What do 4ºC and 6ºC worlds look like in comparison to 2ºC?

Stakeholder Workshop Regional Focus: South Asia - Dhaka, Bangladesh

Background

Climate change is a reality now and being demonstrated across the globe through various climate events. Warming up of our earth with gradual increase of temperature as forecasted by the scientific community is no longer a myth. Climate change beyond 2°C, 4°C and 6°C is to impact severely as a result of "extreme" events to be occurred in upcoming years. To address this problem, an initiative has been taken through the project "HELIX". The High-End cLimate Impacts and eXtremes (HELIX) is a collaborative project funded by European Union, which started in November 2013, with sixteen participating institutions led by the Exeter University, UK. Assessment of climate change will be conducted in HELIX on a global scale under a range of physical and socio-economic condition with consideration of different adaptations scenarios. As a partner of HELIX, we will focus on South Asia(case study: Bangladesh) for the apprehended implications of higher-end scenarios beyond 2°C, 4°C and 6°C and possible warming of the world upon different bio-physical systems of the country like agriculture, water resources, ecology, infrastructure, health, socio-economy etc. In this stakeholder workshop, valued participants are expected to provide their important ideas, expectations and insights upon which this study will get valuable intellectual inputs for the way forward in the research process.



Program

Date and Venue: Workshop was held on 20th August 2014 in BUET, Dhaka, Bangladesh.

Time	Event

08:30 am - 09:00 am	Registration				
09:00 am - 09:15 am	**Overview of the HELIX Project** Prof. A.K.M. Saiful Islam, IWFM, BUET				
09:15 am - 09:30 am	**Stakeholder engagement plan for Bangladesh** Prof. Sujit Kumar Bala, IWFM, BUET				
09:30 am - 09:45 am	**Experiences learned from UK Stakeholder workshops** Asher Minns, University of East Anglia, UK				
09:45 am - 10:00 am	**Experiences learned from Stakeholder workshop in India** Prof. A.K. Gosain, IIT-Delhi, India				
10:00 am - 10:15 am	**Concluding Remarks** Prof. G.M. Tarekul Islam, Director, IWFM, BUET				
10:15 am - 10:40 am	**Tea/Coffee Break**				
10:40 am - 01:20 pm	**High End Climate Change for Extremes (Theme 1)**	**Bio-physical Impacts (Theme 2)**	**Socio-economic and Health Impacts (Theme 3)**	**Adaptation (Theme 4)**	**Governess, Policy and Communication (Theme 5)**
01:20 am - 01:30 am	**Workshop Wrapping**				
01:35 am	**End of Workshop and Lunch**				

Introduction

The planned stakeholder workshop at Dhaka on HELIX Project was conducted as per schedule on 20 August 24, 2014 with active participation from stakeholders as well as from partners' organizations. The aims of the workshop were to create awareness and get feedbacks from the valued stakeholders about the possible impacts of higher-end scenarios with global average warming > 2°C with respect to pre-industrial level and providing decision-makers with a set of credible, coherent, global and regional views for those anticipated scenarios. In total 34 participants from different ministries, GOs, universities, research institutions, and NGOs attended the workshop. The list of participants and their organizations are provided in Annex-1.

An expert feedback form with structured questionnaire was provided to each of the participants to collect their suggestions, feedbacks, views and concerns deem necessary to include in the objectives of the ongoing research project Helix.

The expert feedback form supplied to the participants is provided in the Annex-2. Some photographs of the respected participants during workshop sessions are included in the Annex

3. In a nut shell, the Stakeholders' Workshop was vibrant with the active participations as well as opinion exchanges from our valued stakeholders towards the Helix project.

Lessons Learned

The whole workshop session was interactive, suggestive and informative through mutual participatory understanding. Some of the key suggestions made by the participants of the workshop are listed below:

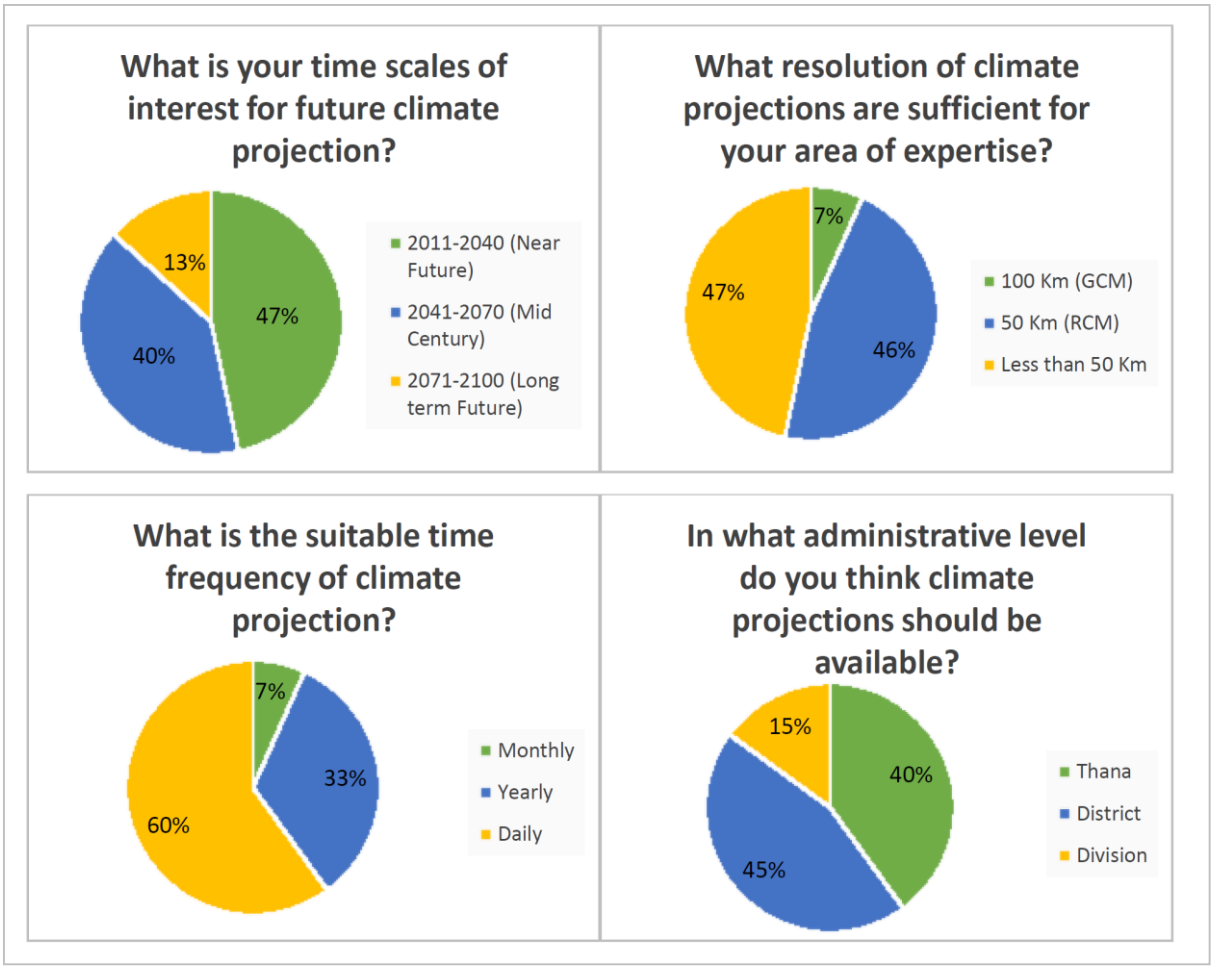
- Bangladesh is a county with the highest density of population in the world. Country's main economic sector is Agriculture which will be more vulnerable under the threat of the changing climate especially under high end scenarios. Therefore, it is imperative to conduct innovative research for developing new heat and salt tolerant verities of crops to combat the extreme climatic conditions.
- A number of participants highlighted that new research should focus on the change of the cropping pattern. As per their opinion, Boro rice is cultivated during Kharif-I seasons (Jan-May) and requires huge amount of water creating drawdown of ground water level and reduction of wetlands. Research on alternate crop calendars, e. g. Aus-Beans-Aman-Wheat can not only reduce water scarcity during the Kharif-I dry seasons but also it can create scope of cultivating of 4 crops in a calendar year. Construction of huge infrastructures especially polders in the coastal areas since 1960s has created a number of environmental issues in the areas.
- Helix should focus on the impact of the change of cyclone intensity, sea level rise, flooding and river bank erosion, and scarcity of drinking water during dry periods.
- Emphasis should be given on health sectors, limitations of the community base livelihood adaptation, and seasonal migration.
- It is essential to see climate change impacts on various sectors in an integrated way rather individually.
- The impact on climate change on both rural and urban life should be focused. Also, study on airborne and water borne diseases should be included in Helix study. As it is not possible to cover many areas of health, a narrative case study can be designed to study life cycle of one disease under the changing climate.
- People exposed to extreme rainfall and temperature (maximum and minimum) working in outdoors can lose the working ability. So, impact on high end climate should be conducted on different age groups. Energy requirement and its impact on vector borne diseases should also be included in the impact study.
- GCM data should be downscaled. RCMs are more suitable for impact studies as topography of the country is very flat. Uncertainties should be minimized by incorporating results from many models.
- Regional cooperation is very important to resolve the water related problems of Bangladesh. It is important to create win-win situation with the neighbouring countries and basin-wise water management has been emphasized. Sharing of hydro-meteorological data is important to combat floods and other natural disasters. Collaborative research (e.g. HELIX project) can help to break the barriers of data sharing with neighbours.
- Ecosystems are one of the most vulnerable sectors under the extreme climate. Study should focus on the issues of ecosystems and assess the economic losses as a result of climate change and can be helpful policy makers. Indirect and direct migration and their impact on gender should be studied.
- Lack of coordination among the different agencies working on climate change was mentioned. However, implementation due to lack of funding is identified as the root cause of many

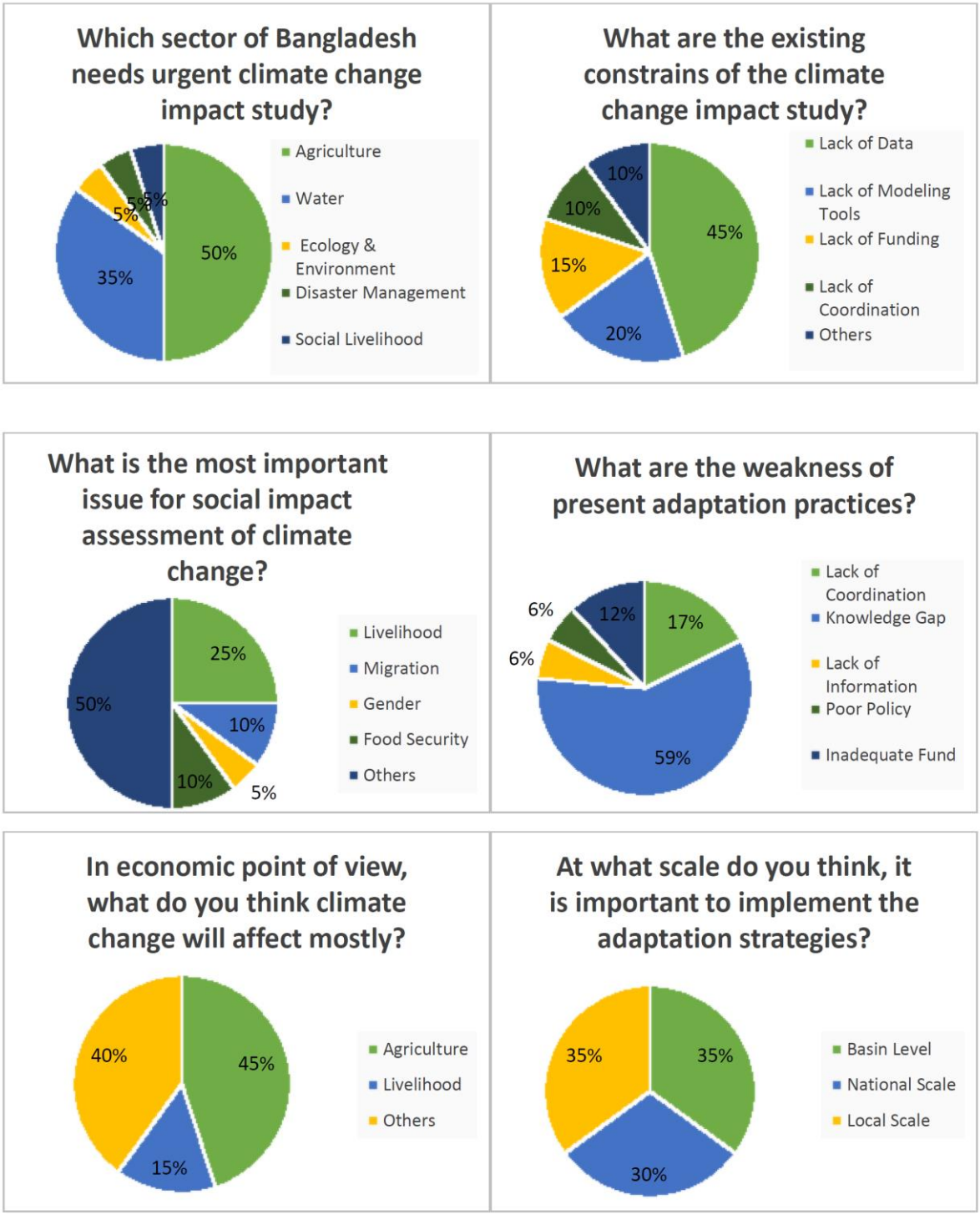
existing problems. It has been requested that this study should suggest some of the adaptation measures that need to implement immediately.

- Communication with the research community as well as with policy makers is essential. Participants suggested to conduct awareness workshop for the journalists about the possible consequences of climate change. Regional and international workshops should also be conducted.
- This study should review all the major findings of the relevant studies and work upon it. A common web based platform can be created where major findings of the relevant studies could be shared.
- It is also suggested to focus on urban issues as these regions will be more vulnerable rather than rural areas due to increasing urbanization.
- NGOs can be good instrument to communicate climate change to the rural areas of the country.
- It is also marked that there is serious lack of man power on crop modelling in major research organizations like BARI to conduct further study based on HELIX output.
- It is also important to calibrate crop models before applying the climate model outputs.
- Specialized search engine can be built which can search only related data and information, like climate change impact. .
- Defining threshold of adaptation is a challenging task. It is also important to identify the threshold value above which adaption is not possible.
- Calibration and validation of impact models should use the extreme events data.
- As no one wants to be climate refugee, preparedness is the key for adaptations. It is also challenging for the rural people to prepare themselves due to lack of understanding, content specific tools and technology and scaling up of the community based adaptation.
- Major findings of the research should be communicated in Bengali language for Bangladeshi people.
- Capacity building of the Government employees is also important for successful implementation of the Government policies.

Analysis of Experts' Feedback

Responses given by the stakeholders on supplied questions for each individual question were analyzed and are presented in the pie charts. The analysis is presented below against each individual question.




Which sector of Bangladesh needs urgent climate change impact study?
Agriculture
Water
Ecology & Environment
Disaster Management
Social Livelihood
50%
35%
5%
5%
5%
What are the existing constrains of the climate change impact study?
Lack of Data
Lack of Modeling Tools
Lack of Funding
Lack of Coordination
Others
45%
20%
15%
10%
10%
What is the most important issue for social impact assessment of climate change?
Livelihood
Migration
Gender
Food Security
Others
25%
10%
5%
10%
50%
What are the weakness of present adaptation practices?
Lack of Coordination
Knowledge Gap
Lack of Information
Poor Policy
Inadequate Fund
17%
59%
6%
6%
12%
In economic point of view, what do you think climate change will affect mostly?
Agriculture
Livelihood
Others
45%
15%
40%
At what scale do you think, it is important to implement the adaptation strategies?
Basin Level
National Scale
Local Scale
35%
30%
35%

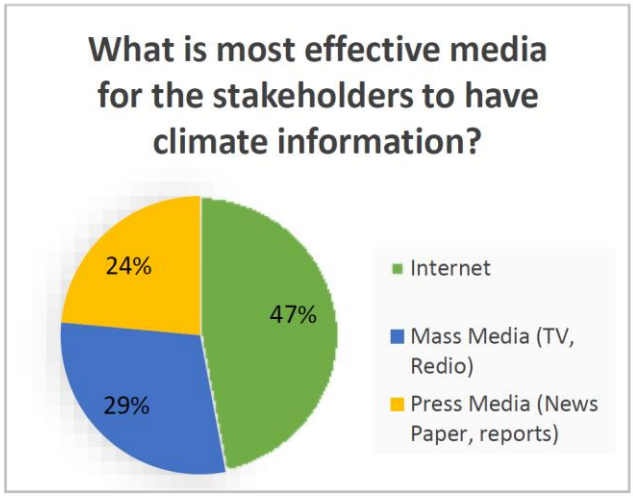


Figure: Response pie charts of expert feedback form.

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Annex-2: Expert Feedback Form

Name & organization	
Area of expertise	
What is your time scales of interest for future climate projection? (i.e. 2030s-early future; 2050s-mid 21st century; 2080s – long term future)	
What resolution of climate projections are sufficient for your area of expertise? (i.e. 100km, 50km, or more fine scale)	
What is the suitable time frequency of climate projection for your field of expertise? (i.e. daily, monthly, hourly or yearly)	
In what administrative level do you think climate projections should be available? (i.e. Division, district or thana level)	
Which sector of Bangladesh needs urgent climate change impact study?	
What are the existing constrains of the climate change impact study?	
What is the most important issue for social impact assessment of climate change?	
In economic point of view, what do you think climate change will affect mostly?	
At what scale do you think, it is important to implement the adaptation strategies?	
What are the weakness of present adaptation practices?	
What is most effective media for the stakeholders to have climate information?	
Any other comments :	

Annex-3: Some Photographs of the workshop

Photo 01: Inaugural session of stakeholder workshop in Dhaka

Photo 02: Interactive discussion sessions was moderated by the HELIX partners.

Photo 03: Participants of the stakeholder workshop in Dhaka

Photo 04: An overview of HELIX project was presented by Prof. A.K.M. Saiful Islam

Summary of Delhi and Dhaka Stakeholder Workshops

Delhi and Dhaka workshops were two successful events that brought out many concerns from the stakeholders, some of these being common to the region and some other specific to the area.

Some of the common concerns include:

- Higher resolution data (GCM downscaled to RCM and at districts and block level)
    - Create user friendly accessibility to Helix outputs
    - Put the scientific information in public domain which is integrated and user friendly
- Need for
    - an integrated ecosystem landscape model
    - institutional and human capacity building
    - Socioeconomic aspects and climate change implications need to be integrated
- Regional cooperation is very important to resolve the water related problems
- Communication of major findings of the research in local language.

Divergent concerns include:

- Bangladesh special need for
    - change of the cropping pattern, change of cyclone intensity, sea level rise, flooding and river bank erosion, and scarcity of drinking water during dry periods, health sectors, limitations of the community base livelihood adaptation, and seasonal migration
- Indian additional requirement of
    - Predictive health models, mapping with respect to climate change, development of early warning systems are some of the priority areas
    - relevance of 2/4/6 deg global temperature on regional scenario specially in India
    - Predictive health models, mapping with respect to climate change, development of early warning systems are some of the priority areas
    - Blend formal and informal science for better communication
    - Differentiation in terms of urban and rural space since urban space usually has higher impact than rural areas
    - Formulate climate smart programs to connect, communicate and collaborate.