I am very much delighted to publish a special edition of newsletter focusing on Global Warming, Climate change impact, adaptation and mitigation. South-western coastal area of Bangladesh is the most vulnerable and disaster prone in terms of global warming & climate Change. LEDARS working in the South-western coastal area for a long time to make a Climate change resilient agriculture and livelihood for the affected people. The area facing with various natural hazards like cyclone, thunder storm, tidal surge, flood, salinity intrusion and drought. People are suffering a lot especially poor and marginal people due to climate change impact like salinity intrusion, water logging, river bank erosion, loss of bio-diversity, ecological imbalance, agricultural land degradation, scarcity of drinking water. As a result peoples are becoming unemployed day by day. So that peoples are forced to engage in collecting forest resources. Many people are migrating from this area for temporary or permanently to search better livelihood options. According to national population census of Bangladesh in 2001 and 2011 that the ratio of male population of Shyamnagar Upazila is lower comparatively female than the previous census. LEDARS has implemented some projects on resilient agriculture & livelihood to reduce climate change vulnerability, water management for accessing drinking and irrigation, promoting science education, health service for distressed people in the south western coastal area of Bangladesh. We are very much thankful to coastal community people and local elites, various local non-government organizations, local Government representatives & departments and donor agencies and organizations to support our initiatives. I would like to pay special heartfelt thanks to all of our devoted staffs who are working efficiently with vulnerable people to fight with the Global Warming & Climate Change impact.

Mohon Kumar Mondal
Executive Director & Editor

Climate Change Vulnerability in South West Coastal Bangladesh
Dr. Md Mujibor Rahman

Introduction: Least developed countries are readily at risk to the negative impacts of anticipated climate change where livelihoods are mostly natural resource dependent. The society and its interaction with the climate affect the climate change impact along with the biophysical characteristics of a certain area. According to the Second Assessment Report, Socio-economic systems are more vulnerable in developing countries as the economic and institutional circumstances are not strong enough. IPCC also describes that vulnerability is highest where sensitivity is high and adaptive capacity is low. Further in the Fourth Assessment Report, the IPCC defines the vulnerability as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. The focus of the researches has been to mitigation and adaptation to climate change after the Fourth Assessment Report of IPCC, which brings in researches that have centered on analysis of human welfare in order to specify the vulnerability of an area. In Bangladesh there have been very few studies done regarding climate change vulnerability. However, in those studies expert judgment has been implemented to weight variables. The use of expert judgment to give the weights may not properly determine the climate change vulnerability as using the expert judgment may have biases due to cognitive limitations. Vulnerability analysis will be clearer and sound if both socio-economic and biophysical indicators are used. While it is difficult for policymaker to indicate vulnerability according to area by taking large number of discrete indicators, there is significant value to capture multiple aspects of climate change vulnerability in smaller number of aggregate indices by spatially-explicit measure.

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**Materials and Methods:** This study aims to assess the vulnerability of the unions of Rampal Upazila with integrated assessment approach using indicator. According to IPCC Fourth Assessment Report vulnerability may be formulated as: Vulnerability = Exposure + Sensitivity – Adaptive Capacity. A higher adaptive capacity is associated with the lower vulnerability while a higher exposure and sensitivity is associated with higher vulnerability. To make the vulnerability indicators comparable they were standardized. The values of each variable are normalized to the range of values in the data set by applying the formula. After standardizing, weight is attached to the inerrability indicators using PCA. PCA is a technique used to extract few orthogonal linear combinations of variables which most successfully capture information from a set of variables.

The objectives of the study are as follows,
- To assess union level climate change vulnerability of Rampal upazila of Bangladesh;
- To visualize relative vulnerability of different unions of Rampal in GIS maps; and
- To identify factors behind components of vulnerability of Rampal upazila;

This study adopts the integrated assessment approach and uses the indicator method to assess the vulnerability of Rampal Upazila of Bangladesh, the study area. Rampal Upazila of Bagerhat district comprising an area of 335.46 km², located in between 22°30' and 22°41' north latitudes and in between 89°32' and 89°48' east longitudes. It is bounded by Bagerhat sadar and Fakirhat upazila on the north, Mongla and Morrelganj upazila on the south, Morrelganj and Bagerhat Sadar upazila on the east, Batiaghata and Dacope upazila on the west.

**Results and Discussion:** The weight of variables for adaptive capacity, sensitivity and exposure is measured from Principal Component Analysis (PCA). The heaviest factor loading from PCA is used as weight for the variables. It is seen that adaptive capacity can be categorized as income and infrastructure, education, road and agricultural facilities. Similarly, sensitivity can be categorized as casualties, physical damage, environmental and social. While exposure can be categorized as climate extremes due to rainfall, increasing temperature and natural hazards.

**Exposure:** The study area, Rampal upazila, mainly shows a lower level of exposure to climate change. The Rampal union, which is relatively more urbanized and developed, has lowest exposure with a score of 0.37 while Pankhali union a less developed relatively remote area has highest (0.56) relative exposure (Table 1). Though most of the unions are relatively low in exposure, Hurka and Ujalkur union have relative exposure score between 0.43 and 0.49 which is classified as moderate level of exposure (Table 1). On the other hand, Rajnagar and Perikhali has a relative exposure higher than 0.49 which is high (Table 1).

**Sensitivity:** Unlike exposure the overall sensitivity of Rampal upazila is moderate to high. From table 4, the lowest sensitivity is found in Gaurambha union (0.28) while Rampal &Bhojpatia union holds the highest rank together (0.50) (Table 1). Baintala, Rajnagar, Hurka, Bashatali and Ujalkur union have moderate relative exposure value between 0.35 and 0.42 (Table 1).

**Adaptive Capacity:** Rampal upazila has an adaptive characteristic. The relative score for adaptive capacity varies between 0.50 to 0.77 (Table 1). Most of the unions have moderate to high level of relative adaptive capacity. Baintala, Bashatali and Perikhali union are found less adaptive capacity with scores below 0.58 (Table 1). Ramjanagar and Ujalkur union are mostly adaptive to climate change having relative score 0.74 to 0.77 (Table 1). However, beside the above mentioned four unions, rest of them are found between 0.58 & 0.68 (Table 1).

**Vulnerability:** Perikhali union is the most vulnerable among the unions of Rampal upazila. Perikhali union has the highest exposure and lowest adaptive capacity, as mentioned in previous sections, responsible for its highest relative vulnerability score. On the contrary Ujalkur union has a sensitivity score close to minimum...
Climate Resilient yearly development plan declared by 2 Union Parishads in southwest coastal Bangladesh

The union parishad (local government) is an institution directly elected by grassroots level peoples who makes a lot of plans for the development of local peoples. Union Parishad (UP) can play important role for the sustainable development of the people. But most of the developments are not sustaining because the plans are not taken by considering climate change vulnerability.

To make a sustainable development plan and to increase capacity of local Union Parishad LEDARS has initiated pilot program with two unions to formulate and implement local climate adaptation plan. An agreement has been signed between 2 UPs, Upazila Parishad, Upazila Nirbahi Officer (UNO) and LEDARS. Under the initiatives LEDARS is assisting to Union Parishad to develop village Local Adaptation Plan of Action (LAPA). As a result of the initiatives yearly climate resilient development plan and open budget was declared on 28 and 29 May 2018 of 2018-19 fiscal year in 12 no Gabura and 09 no Burigoalini unions of Shyamnagar Upazila under Satkhira district. In this yearly action plan and budget some climate resilient activities were included and these are canal & ponds re-excavation for adaptive agriculture, pond excavation for pure drinking water, PSF establishment and old PSF repairing, repair rain water reservoir, canal excavation and culvert establishment to fix water logging, raise embankment to prevent river erosion, take initiatives to establish forestry in char lands and conservation, allocate money for emergency assistance to suddenly affected disaster, raise the plinth of homestead and fields of institutions and repair roads to raise considering sea level rise. The allocation of climate resilient development budget is 37.5% of the total declared budget. As a climate change focus organization, LEDARS is helping Union Parisads under the project “Strengthening Livelihood Security of Climate Change Vulnerable People” funded by Bread for the World.

Rice and vegetable seed distributed to promote resilient agriculture in southwest Bangladesh

LEDARS distributed Saline, drought and water logging tolerant rice and saline resistant vegetable seed among 756 farmers. Farmers in the southwest coastal region of Bangladesh could not grow rice and vegetable as usual. LEDARS has been working with farmers and vulnerable women to increase adaptive capacity to climate change by the project “Strengthening Livelihood Security of Climate Change Vulnerable People”. Under the project, LEDARS distributed vegetable seeds and organic fertilizer among 404 farmers and distributed 3.5 ton rice seeds among 352 farmers. To increase resilient agriculture LEDARS distributed Seeds in the Burigoalini, Munshigonj and Kashimari union of Shyamnagar Upazila and Uttar Bedkashi union of Koyra Upazila.

LEDARS distributed Salt tolerant fruit plant

The climate of the earth has been changing gradually due to reducing the environmental balance and south east coastal zone is the most vulnerable area in Bangladesh. With a view to reduce climate change hazards LEDARS has taken initiative to distribute salt tolerant fruit plant to the climate vulnerable people. LEDARS distributed 9840 salt tolerant fruit plant to 820 house hold of 05 Unions of Shyamnagar and koyra Upazila under Satkhira and Khulna District. LEDARS organized an inauguration program at head office in Munshigonj Union of

[Pleas see page-5]
Identifying Controlling Factors of Vulnerability Components: Though vulnerability is the function of exposure, sensitivity and adaptive capacity in this case adaptive capacity has the highest negative influence (correlation coefficient of -0.72338) on vulnerability. The factor analysis of the indicators of exposure showed river erosion, salinity intrusion and deforestation to be influential on the vulnerability component exposure. While disability is the indicator that makes a household most sensitive to climate stresses, previous impacts of disasters like injury, household destruction, crop damage and damage to fisheries are almost equally influential to sensitivity of the study area. Adaptive capacity is highly influenced by health service, electricity, drinking water availability, house structure, clone shelter, etc. but mostly controlled by the availability of safe drinking water (correlation coefficient 0.721611).

Conclusion: As Bangladesh holds highest risk to be affected by effects of climate change, understanding of vulnerability to climate change needs to be implicitly introduced before any development and adaptation intervention. Since the local authorities play important role in the implementation of strategies for adapting to climate change, this study analyses union wise climate change vulnerability in Rampal upazila of Bangladesh. The present study shows that climate change vulnerability in Rampal upazila depends mainly on adaptive capacity. It is also seen that natural hazards increase the overall vulnerability. It is observed that southern unions are more vulnerable because of low adaptive capacity and higher natural hazards. Especially, Perikhali union have the highest climate change vulnerability mainly due to low adaptive capacity as well as occurrence of natural hazards. So, in order to enhance resilience to climate change in Rampal upazila, it is necessary to prioritize measures which increases adaptive capacity but mitigates natural hazards. For that, it is necessary to map vulnerability using more robust indicators denoting land-use change and topography. It is also imperative to understand the disparity of climate change vulnerability even within a union in order to identify social groups, communities, and households who are prone to adverse impact of climate change.

<table>
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<tr>
<th>Unions</th>
<th>Exposure</th>
<th>Sensitivity</th>
<th>Adaptive</th>
<th>Vulnerability</th>
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<td>0.41</td>
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<td>0.74</td>
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<tr>
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<td>0.35</td>
<td>0.59</td>
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<tr>
<td>Bashitali</td>
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<tr>
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<tr>
<td>Ujalkur</td>
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<td>Malliker Ber</td>
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<td>0.47</td>
<td>0.61</td>
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</tbody>
</table>

*Green color=Low; Yellow color= Moderate; and Orange color= High
Shyamnagar Upazila by the financial aid of Bread for the World under the project “Strengthening Livelihood Security of Climate Change Vulnerable People”. The program was inaugurated by Mr. Kamruzzaman, Upazila Nirbahi Officer of Shyamnagar Upazila. LEDARS has been working with climate vulnerable people since 2003 with a view to reduce climate change vulnerability through initiating climate resilient activities.

Scholarship money distributed to the meritorious student

LEDARS distributed scholarship money to the meritorious student of secondary school under the project titled “Promoting Science Education in Secondary School” supported by Bangladesh Freedom Foundation. The scholarship has been providing from Pratichi (Bangladesh) Trust which is a part of the project activity. LEDARS organized an event where 5 meritorious student received cheque of 3600 taka. From the previous two years back that students have been receiving the money as scholarship. With a view to promote science education LEDARS is working in 30 schools in Shyamnagar Upazila of Satkhira District. LEDARS started the science education program science 2014 at secondary school level to promote science education to overcome science education phobia of the students. LEDARS also formed science clubs in the schools. The science clubs organizes science fair, debate competition, publish wall magazine and tree plantation program. The scholarship is providing to the students as an incentive to inspire them for advancing the science education. LEDARS has been working with the students of climate vulnerable costal area to become as a progressive minded people of the country.

Cash support provided to climate vulnerable people to strengthen the sustainable IGA

Due to climate change livelihood of the vulnerable people become threat full. With a view to reduce climate change hazards, LEDARS has taken initiative to provide cash support to promote AIGA to the climate vulnerable people. Cash support is providing to the beneficiaries as an incentive to create alternative livelihood activity. LEDARS provided cash support to 50 women & 09 men of 02 Unions of Shyamnagar Upazila under Satkhira District. LEDARS organized a cash support distribution program at head office in Munshigonj Union of Shyamnagar Upazila with the financial aid of Bread for the World under the project “Strengthening Livelihood Security of Climate Change Vulnerable People”. The program was inaugurated by Mr. Kamruzzaman, Upazila Nirbahi Officer of Shyamnagar Upazila. LEDARS is working with climate vulnerable people in the agriculture, water and education sector with good reputation.

Media personnel workshop on climate reporting held in Satkhira

LEDARS organized two day’s workshop on 30 July to 31st July, 2018 on climate change issue for local media personnel at Center for Coastal Climate Resilient (C3R) to enhance capacity of media personnel to publish and broadcast news on climate change impact and peoples sufferings. The program was organized under the project of “Strengthening Livelihood Security of climate
change vulnerable people" funded by Bread for the World. The Deputy Commissioner of Satkhira district Mr. Md. Iftekhar Hossain inaugurated the program. In this workshop participants received knowledge on climate change concept, its impact and adaptation. Participants also received knowledge of importance for preparing report on climate change issues, techniques of preparing news for print media and report of climate change issues related with gender. The workshop participants visited in the climate vulnerable areas to prepare news on climate change impact. At the end of the workshop they have prepared one year plan when and what topic they will broadcast the news in their respective newspaper with their regular news. The workshop was participatory and media personnel expressed their gratitude and thanks to LEDARS. With a view to strengthen livelihood security of climate vulnerable people, LEDARS have been working with them since 2003 in southwest coastal area of Bangladesh.

**Inter-school science fair inspired the junior scientist for innovation in local context**

To inspire the young scientist for innovation and enhance science education, LEDARS has arranged Inter School Science Fair 2018 at 28 February 2018 at Shymnagar Upazila Complex ground under the project of Promoting Science Education Promotion in Secondary School funded by Bangladesh Freedom Foundation (BFF). Junior scientist of 30 secondary schools and 02 colleges has demonstrated their innovative projects like wooden freeze, helicopter, mitigating technology of the traffic jam on flyover, electric donation box, ATM booths, water vehicles, press machines, energy produced technology by biological goods, air cooler, disaster resilient house, bioscope, damper, solar technology, auto brush cleaner, etc. During the fair the students were participated in different events like debate competition, music competitions, science quiz competition and essay writing competitions. Nawabenki High School has been awarded for best stall and Ramjannagar Union. Tofazel Bidhapith awarded for the best science club of 2018. Equipment of Mini science laboratory has been given to best stall and science clubs. The co-sponsor of the event was Trust Bank Limited, SBAC Bank Limited, Sonar Bangla Paribar, Tamim Traders, Rokon Book Depot, Mukto Chapakhana, Islam Brothers, Moushumi Construction.

**LEDARS distributed fuel efficient cook stove among Rohingya people**

EDARS distributed fuel efficient improve cook stove in Rohingya camp at 22 February 2018 to reduce use of fire wood and briquette as it is major environmental concern. Rohingya issue is a widely discussed issue now in Bangladesh and even in the south Asia. According to IOM Needs and Population Monitoring (NPM) survey, 688,000 Rohingya people were arrived as of 21 January 2018, reported by Inter Sector Coordination Group (ISCG). The Rohingya People took sheltered in Teknaf and Ukhiya Upazila of Cox’s Bazar district from 25 August 2017. According to South China Morning Post published on 17 January 2017 that more than one million Rohingya people are staying in Bangladesh. They are provided by shelters and reliefs. About 4,440 acres of forest land has been destroyed to make shelter homes in Bangladesh. Besides this they are cutting trees from the local forest to building shelter homes and cook food. According to the local forest department, every family needs at least 5 kg of wood daily. Therefore, it has been urged by Ministry and Forest and local administration to provide fuel efficiency cook stove. LEDARS started to a pilot project entitled “Improve Environmental Condition of Rohingya Camp in Bangladesh” with support of UK based NGO, HANDS. Under the project, LEDARS initially distributed 500 fuel efficiency cook stoves among Rohingya.
people in Jamtoli. It is a concrete and iron made potable cook stove which designed by IDCOL. This stove can reduce up to 50% use of firewood or briquette.

Village seed house: towards a climate resilient village

Seed is the most important technology for agriculture. From the ancient time, farmers collect their seed from their production, preserve and used year-round. It was sustainable practice for agriculture depended livelihood. Once upon a time every farmer house was small seed store. But due to introduce high yielding, hybrid, GM verities and market based economy, farmers have lost their traditional practice and become market dependent for seed. To reduce market dependency and establish seed security again, LEDARS is trying to develop village seed producer in coastal area under the project “Strengthening Livelihood Security of Climate Vulnerable People” supported by Bread for the World. Already 40 village seed producers has been developed their house as a village seed house. The project beneficiaries and community people are collecting and exchanging seed from that seed houses. Village seed producers (Seed house) are playing significant role to establish seed security, reducing market dependency and promoting indigenous seed exchange practice which is most important for climate resilient agriculture in coastal area.

Parvin Akter now happy by using bio-sand filter

Parvin Akter is 31 years of old and she lives in Iswaripur village of Iswaripur Union of Shyamnagar Upazila under Satkhira District. Her family member is 4 including husband and two children. They were habituated to use pond water but in 2009 their village was affected by Aila. All the pond were polluted by saline water and as a result there was a severe scarcity of pure drinking water. Every day Parvin had to collect drinking water 2 kilometer far from her house and that purpose she had to spend 40 taka per day. Her husband was only one earning person and he could not earn sufficient money to maintain their family. Sometimes it was not possible to buy water due to crisis of money. So that due to lack of money they were forced to use pond water. Sometimes her school going daughter had to collect water from far places and that’s why sometimes she had to be absent in school. They were infected with diarrhea, dysentery and other water born disease. Even they used to drink less amount of water due to unavailability of drinking water. At this moment Parvin Akter came to know from her neighbor that LEDARS is working with installation of bio-sand filter. LEDARS is working on bio-sand filter with the support of OHorozone, USA in the project titled “Bio-sand Filter in South Western Coastal Bangladesh” in Shyamnagar Upazila creating access to pure drinking water. Parvin was interested to take a bio-sand filter to relief from the problem. After that she received a bio-sand filter and got an orientation to use of bio-sand filter. Now her family members are drinking bio sand filter water and as a result they are free from all types of water borne disease. Now she and her daughter does not need to go far way to collect drinking water. Parvin is also using this filter water for cooking purpose. Now her daughter Hashi is going to school regularly. Parvin say “bio-sand filter helps my family to relief disease, save time, money and turned my life in to happiness”.
Bisakha shows a good practice in her community

Bisakha Gayin was crying to remember about the devastating cyclone Aila while she was telling about her success story. She is 45 years old and born in west Jelekhali village of Munshiganj Union under Shyamnagar Upazila of Satkhira district. Her husband depends on agricultural work to run their family. They had only 80 decimal of land including homestead. Her husband was working hard but it was very difficult for one hand to run the family. Bisakha thought that she should help her husband by involving alternative income generation activities. With a view this thinking she started to communicate with peoples who can help her with income generation. At that time she got to know from a neighbor that LEDARS has Climate Resilient Group (CRG) in her village. Bisakha met with the LEDARS staff and expressed her interest to be involved with LEDARS’s CRG group. After that she included in Sundarban Climate Resilient Group as a vegetable cultivator under the category of alternative income generating activities (AIGA). She gained knowledge by attending in CRG meeting and realized that chemical fertilizer is harmful for both soil and human health. She got training on vegetables cultivation and vermicompost production. After receiving training she motivated to involve compost production. In 2017 she received cash support of 10000 taka for vermicompost production from LEDARS under the Project titled “Strengthening Livelihood Security of Climate Change Vulnerable People” funded by Bread for the World. After receiving cash support she made vermicompost production pit. Up to June, 2018 she produced 725 kg vermicompost which market value is taka 10,875. She uses this compost in her vegetables garden and in the rice field. Along side she started to sell the vermicompost to the local people. The neighbors of Biskha Gayin are getting the compost with low price and it is also creating an opportunity of availability in the community for use. Now there is 200 kg vermicompost in her compost house which market value is 3000 taka. Bisakha Gayin feels happy and satisfy that she is contributing in her family to run and also contributing in the community to enhance a good agricultural practice. “Bisakha Gayin’s dream is to spread this technology over the community as an alternative income generation activity and also as a good agricultural practice.”

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