



INTERNATIONAL SEMINAR 2010  
CLIMATE CHANGE AND  
ENVIRONMENTAL  
CHALLENGES OF 21<sup>st</sup> CENTURY

7-9 December 2010



Institute of Environmental Science  
University of Rajshahi, Rajshahi- 6205  
Bangladesh



Sponsors:



# International Seminar

## Climate Change and Environmental Challenges of 21<sup>st</sup> Century

7-9 December 2010

### Programmes and Abstracts

Institute of Environmental Science (IES)  
University of Rajshahi, Rajshahi-6205, Bangladesh

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#### **Editors**

Dr. Md. Golam Mostafa  
Dr. Md. Redwanur Rahman

#### **Cover Design**

Abdullah Al-Maruf, Md. Shafiul Alam and Monoj Kumar Ghosh  
Department of Geography and Environmental Studies, University of Rajshahi

#### **Computer Compose**

S.M. Helal Uddin, Institute of Environmental Science, University of Rajshahi

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Mostafa, M.G. and Rahman, M.R. (eds.). 2010. International Seminar on “Climate Change and Environmental Challenges of 21<sup>st</sup> Century” 7-9 December 2010, Institute of Environmental Science, University of Rajshahi, Rajshahi-6205, Bangladesh, 118 p.

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Printed at Uttoran Offset Printing Press, Greater Road, Rajshahi, Bangladesh  
Phone : 0721-773782



## International Seminar-2010

Climate Change and Environmental Challenges of 21<sup>st</sup> Century

7-9 December 2010

Programmes and Abstracts

Venue  
University of Rajshahi

Organized by  
Institute of Environmental Science (IES)  
University of Rajshahi, Rajshahi-6205  
Bangladesh



**Vice Chancellor**  
University of Rajshahi  
07 December 2010

## **Message**

I am glad to know that, the Institute of Environmental Science, University of Rajshahi is going to organize an international seminar titled 'Climate Change and Environmental Challenges of 21<sup>st</sup> Century in collaboration with the Government of Bangladesh and several of our development partners.

The theme of the seminar is very timely as Bangladesh is facing a range of environmental challenges that will be seriously exacerbated by climate change. The Intergovernmental Panel on Climate Change (IPCC) estimates that by 2050, 17% of Bangladesh will have been claimed by sea level rise, forcing 20 million people to relocate. The impact will put additional stress on the country's human and economic development, creating a huge challenge for the future.

The country is already experiencing the affects of serious environmental damage. Water, land and air degradation, biodiversity loss and natural disasters are negatively impacting the lives of people's across the country from everyday challenges to threats to livelihood. Impacts of these climato-environmental factors are felt most often and hardest by those living in poverty that rely heavily on natural resources. In this way the environmental degradation contributes to preventing the achievement of sustainable and equitable human development.

I hope, this three day long international seminar will help us in understanding the climate change and environmental challenges thereof better. Discussions there will help to identify both of our short and long term impacts, and formulating a sustainable strategy for adaptation.

Wish the seminar a complete success.

**Professor M. Abdus Sobhan**



**Pro-Vice Chancellor**  
University of Rajshahi  
07 December 2010

## **Message**

Climate change is no more a distant possibility, it is now a real threat for the lives on the planet earth. It makes us feel its presence/ appearance through various indications. Climate of our planet is changing gradually and it is apprehended that in the near future mankind will begin to face its consequences which could be a horrible one. Scientists are warning us about probable multidimensional adverse effects of climate change. Sign of climate change are evident in the increase of temperature, change of water vapour, increased precipitation, change of ocean and air circulation patterns, change of rain patterns, more frequent floods and cyclones, water scarcity, sea-level rise etc. There are sign which indicate that significant global warming will take place during this century. This change will damage the environment of the oceans which could lead to harsher winter weather condition, reduced soil moisture and intense winds in certain regions of the earth. Scientists believe that once temperature rises above threshold of toleration, adverse weather conditions could develop relatively abruptly. Such an abrupt climate change could destabilize the geopolitical environment, leading to conflicts because of resource constraints such as food shortage, decreased availability of fresh water etc. Thus tensions could mount around the world, many scientists believe that the plausibility of severe and rapid climate change is higher than the world community is prepared for. If it occurs, current gradual warming trend will to disrupted.

It is apprehended that due to climate change. Bangladesh will have to face persistent typhoons and a higher sea-level will create storm surges that might cause significant coastal erosion, making a vast area of Bangladesh uninhabitable. Beside this, sea-water will contaminate fresh water supplies creating a humanitarian crisis. Massive emigration will occur to create tension in the neighbouring countries.

Climate affects human health in different ways as people of different regions of earth are accustomed to different style of life developed according to its geography. People highly dependent on agriculture for their livelihood are at high risk of so many diseases, mental disorders in particular. Infectious diseases, water and food contamination, allergic symptoms and cardiovascular diseases may be prevalent due to weather changes. Various climatic parameters such as temperature, humidity, atmospheric pressure, rainfall and hours of sunshine contribute to seasonal variations in a mental disorder namely bi-polar disorder. Dislocation of people from uninhabitable area will increase the density of population in area other resulting mental problems of the people residing there. Beside this, economic hardship may cause depression among the victims.

I hope, the conference organized by the Institute of Environmental Science will address issues mentioned so far and the like. It will contribute to our understanding of the environmental challenges in the near future and help prepare necessary action plans to face it. I wish the conference a success.

**Professor Muhammad Nurullah**



**Treasurer**  
University of Rajshahi  
07 December 2010

## **Message**

I am really very happy, and I feel very delighted to learn that the Institute of Environmental Science of Rajshahi University is going to hold a three day international seminar under the auspices of Rajshahi University. The seminar will be on “climate change and environmental challenges of 21<sup>st</sup> century”. The subject selected for the seminar has really been very judicious in view of the fact that global climate changes, embodied in what is called the global warming has recently emerged as the most serious problem of human survival on the earth surface and leaders and intellectuals all over the world have awakened to the necessity of working more cordially and more unitedly to reverse the current worsening situation in global climate regime. I am sure that scholars from home and abroad will find this seminar as an appropriate forum to combine their resources of heads and hearts and through thread bare analyses would come closer to factors which cause continued increase in global temperature and would be crowned with success to evolve and suggest world development strategy which would ensure growth without further injury to nature.

The planners and organizes of this seminar are men of active habit and men with imagination and vision required for human emancipation from various odds of live. I wish them God speed, and sincerely hope that the success of the seminar will be brilliant and splendid. I also thank the Rajshahi University Authority for helping initiate and rendering unstinted cooperation to Institute to ensure successful accomplishment of its laudable programme.

**Professor Md. Abdur Rahman**



**Chairman**  
Organizing Committee  
International Seminar-2010  
Climate Change and Environmental  
Challenges of 21<sup>st</sup> Century  
and  
**Director**  
Institute of Environmental Science  
University of Rajshahi  
07 December 2010

## Message

Palaeoclimatological and palaeogeological evidences suggest that the earth evolved through continuous geologic and subsequent climate changes during its total life time right from its origin about 4600 million years ago as a ball of molten rock at a temperature of about 4000°C. It took many million years for the earth to cool down enough for a crust to form. The first forms of life are believed to date from 3500 million years ago, and they lived without oxygen. Oxygen came much later, since it is mainly produced by plant. Thus the earth's climate started changing. Although scientific knowledge about the details of these changes is really scanty and sporadic, it is more or less established that life on earth passed through different types of adaptation and adjustments for their survival. The result of which is the present earth's biosphere pattern. Major climate changes of recent time, such as those of the Ice Ages, have drastic effect on biotic assemblages. When climate change is gradual, species may have time to adapt or migrate to more suitable locations. Where climate change is relatively more abrupt, many organisms are unable to respond before conditions exceed their tolerance limit. Whole communities may be destroyed, and if the climate change is wide-spread, many species may become extinct. Perhaps the most well studied example of the phenomenon is the great die-off that occurred about 65 million years ago, at the end of the Cretaceous period. Most Dinosaurs along with 75 percent of all previously existing plants and animal species became extinct, apparently as a result of sudden cooling of the earth's climate (Glacial age). Geologists and climatologists suggest that this was not an isolated event. There appeared to have been several, or even uncountable number of climate change events took place resulting in various changes on biosphere, hydrosphere and atmosphere parts of the earth. The constructional rearrangement of the earth's crustal plates and subsequent climate changes forced the spatial pattern of plants and animals to be reorganized or re-synthesized to give the climex status of the phenomena. The changes were added with frequent irregularities and instabilities, particularly during the latter part of Quaternary period (during the last 2.6 million years), started resulting in more and frequent environmental disasters.

Climate change is more a natural phenomenon, and earth's history suggests that this gradual and natural change gave us enough scope for adaptations. But unexpected quicker changes, in the form of sudden fluctuations in climate components are the real culprit for environmental disasters. Scientific evidences suggest ever increasing human intervention into the nature that contributes to the unexpected changes and anomalies in the system. For example we are increasingly emitting carbon gases into the atmosphere which is influencing the regular thermal

and hydrodynamic system of the earth causing severe weather disturbances in the form of cyclones, over rain, droughts, land slides, ocean current shifts, marine fish resource shifts etc. Although it is still not scientifically proved fully, *El Nino* and *La Nina* are two possible climate oscillations those are responsible for above disasters. Measurements of temperature over the last 100 years show that, on average, the earth has become warmer by about 0.5° C during this time. Polar and Antarctic ice caps have melted significantly. We really don't know how much ice have melted from the glaciers located at the continents. The largest glacier in Iceland, Vatnajokul have lost about 1.5 percent of its ice at its southern margin. The facts are not really encouraging for us. It indicates a possible sea-level rise and targets its impact on coastal low lands across the continents and islands. At the current rate of global warming the sea-level is expected to rise about 1 meter by 2030. A one meter rise in sea-level would make about 15 million people homeless in Bangladesh. It would flood one-sixth of Egypt's farmland. Large areas of London would be under water and spectacular Venice would be destroyed.

Now the question is what we can do to stop the change. Clearly enough, we can not do much. But we can allow the climate changes to be more normal and smooth by reducing human interventions which will give us more breathing space to adapt the change. A United Nations conference on global warming in 1995 decided that the earth is getting warmer definitely due to greenhouse effect – a result from the fossil fuel burning. Is the fact realized by the countries burn plenty fossil fuel? To be more specific about Bangladesh, as a result of high population growth and growing GDP, intensifying human economic activities is increasing its pressure on land and natural resources. By now, pressure on land has reached almost the extreme critical level. It is already evidenced that productivity of soil is declining. Due to increasing need, water-shortage is getting phenomenal in both Bangladesh and India directing to an international political and social conflict, where China has recently joined by her intention to withdraw water from the upper Brahmaputra. The possibility of sea-level rise due to global warming is just a demon-like threat in front of us. What to do if we loose a big chunk of our land to the sea? Where will this huge number of population migrate? Conflicts are becoming more and often among neighboring countries of Bay of Bengal region on territorial waters which is obviously from the interest on marine resources exploitation. Infectious diseases control has become difficult among bordering nations due to cross-border migration of people and animals. So the questions of easing the pressure on environment in the name of resource exploitation as well as solving the problem through international partnership are the only options. Days of isolated endeavor has ended. The world is now getting integrated through the concept of social and economic globalization. We must utilize this advantage (i) to rationalize the exploitation of natural resources, (ii) to reduce human contribution to climate change synthesis, (iii) to increase understanding among different nations for a stronger climate policy instead of isolated stand-alone endeavor, and (iv) to invent effective strategies for sustainable adaptation methods for both human kind and for the whole living organisms. The international seminar on Climate Change and Environmental Challenges of 21<sup>st</sup> Century is expected to stimulate academics and researchers to settle down these issues through the exchange of ideas and cooperation without wasting a single day, which is too precious for the little earth.

**Professor Raquib Ahmed**



**Secretary**  
Organizing Committee  
International Seminar-2010  
Climate Change and Environmental  
Challenges of 21<sup>st</sup> Century  
and  
Associate Professor  
Institute of Environmental Science  
University of Rajshahi  
07 December 2010

## **Message**

This seminar is being arranged at the moment when the world is threatened by increasing global warming and by the associated climate change impacts. South Asia faces many challenges from fast-growing population, sea level rising, frequent cyclones, regular flood and drought, and so is becoming the most climate-vulnerable region in the world. Hence, more attentions are needed to adopt development strategies for climate change risk and its impact on development and poverty.

Bangladesh is being considered as one of the most vulnerable countries in the world for the climate change impacts. The country has 580 km of coastline and about 21% of the total population living in coastal areas are the most vulnerable to the effects of climate change than any other part of the country.

The scientist community considers the climate change is already happening and has been demonstrated through various recent extreme climate events around the world, including increases the intensity and frequency of cyclones and earth quakes, severe and sudden floods in South Asia, heat waves in Europe, and snow storms in North America. A little increase in global temperature can have major impacts on the environment, including changes to water availability and crop productivity, the loss of land due to sea level rise, and the spread of diseases. These adverse impacts of climate change may increase the threat of world peace and security. Hence the most critical interventions are urgently needed for supporting the sustainability of the world and as well as interventions for increasing adaptive capacity of the poor and vulnerable communities.

In this seminar, the recent examples, case study and research results on climate change will be discussed by the participants from developing and developed countries. Participants will discuss their latest scientific findings, and share the knowledge on climate change, and prepare recommendations to take measures for mitigation of the impacts for state decision makers. The seminar will be a unique opportunity to share the knowledge and exchange views on the impacts of climate change and possible challenges for the sustainability of the earth. Let us join hands to overcome the challenges of climate change issues and to build a sustainable and peaceful and a more habitable world.

**Dr. M. Golam Mostafa**

International Seminar-2010  
Climate Change and Environmental Challenges of 21<sup>st</sup> Century

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Assistant Professor  
Institute of Environmental Science (IES), University of Rajshahi

**Detailed Programme**  
**Venue : Senate Building**  
**Inaugural Session**

**Day -1: December 7, 2010**

9:30	Arrival & Registration
10:00-10:05	Guests take their seats
10:05	Inaugural session begins
10:05-10:15	Recitation from Holy Quran
10:15-10:25	Welcome address by the Secretary, Organizing Committee, <b>Dr. Md. Golam Mostafa</b>
10:25- 9:35	Address by the Guest of Honour <b>Mr. Mohammad Abdul Qayyum</b> , National Project Director, Comprehensive Disaster Management Programme (CDMP), Ministry of Food and Disaster Management
10:35- 10:45	Address by the Special Guest <b>Prof. M. Abdur Rahman</b> , Treasurer, University of Rajshahi
10:45-10:55	Address by the Special Guest <b>Prof. Mohammad Nurullah</b> , Pro Vice-Chancellor, University of Rajshahi
10:55-11:05	Address by Chief Guest <b>Prof. M. Abdus Sobhan</b> , Vice-Chancellor, University of Rajshahi
11:05-11:15	Address by the Seminar Chair Professor <b>Dr. Raquib Ahmed</b> , Director, Institute of Environmental Science, University of Rajshahi
11:15 -11:45	Tea/Coffee
11.45.12.45	<b>Keynote speech</b> Speaker: <b>Prof. Dora Marinova</b> Curtin University Sustainability Policy (CUSP) Institute, Curtin University of Technology, Perth, Australia

## **Technical Sessions: (Oral Presentations)**

### **Venue : Deans' Complex**

**Day -1: December 7, 2010**

**Main Conference Room (2<sup>nd</sup> Floor)**

Session 1A: Climate change, Environment and Geography:

Session Chair: Prof. Dr. A.H.M. Abdul Baquee, Dept. of Geography and Environment,  
Dhaka University, Bangladesh

Time: 2.00-3.30 PM

<b>Time</b>	<b>Abstract No.</b>	<b>Title</b>	<b>Authors</b>
2.00-2.12	11225	Climate Change in Iceland	Gregor C. Falk
2.12-2.24	11224	Climate Change in the Alps	Johannes Bertsch
2.24-2.36	11235	Trend in Rainfall and its Relation with Thunderstorm Frequency During the Pre-Monsoon Season in Bangladesh	Samarendra Karmakar
2.36-2.48	11053	Land use Change in Arid Region: Dimensions In Process and Modeling the Prediction of Desertification Using Remote Sensing and GIS	Raquib Ahmed, Mohammad Arshad and Bao Anming
2.48-3.00	11243	Impact of Climate Change on the Seasonal Pattern of Bangladesh: A Case Study of the Greater Rangpur District	Md. Zakaria Hossain, Md. Jahanur Rahman and Md. Abul Kalam Azad
3.00-3.12	11229	Environmental Impact of Opencast Coal Mining: A Case Study of Phulbari, Dinajpur	E. Haque and A.K Azad
3.12-3.24	11095	Recent Climate Change Trend Analysis and Future Prediction on old Brahmaputra River, Bangladesh	Md. Rubayet Mortuza, Golam Arif Rabbani and Umma Salma Rashid
3.24-3.30		Open discussion	

### **Dean's Conference Room (1<sup>st</sup> Floor)**

Session 1B: Climate Change, International Conflict and Social Mitigation

Session Chair: Prof. Mohammad Mizanuddin, Dean of Social Science

University of Rajshahi, Bangladesh

Time: 2.00-3.30 PM

<b>Time</b>	<b>Abstract No.</b>	<b>Title</b>	<b>Authors</b>
2.00-2.12	11055	Climate Change Rhetoric in Bangladesh: A Curse or a Blessing?	Amzad Hossain and Dora Marinova
2.12-2.24	11116	Past and Future Climatic Trends of Precipitation and Temperature in Sri Lanka	Anushka Rajapaksha, Jayantha Obeysekera, Michelle Irizarry, Ruvini Gunathilake, Nelun Fernando and Meththika Vithanage

2.24-2.36	11190	A Case Study of Water use Conflict in South Asia (Ganges-Brahmaputra-Meghna Basin) and Their Perspective Impacts on Bangladesh	Md. Mosiur Rahman, Abu Hena Mostufa Kamal, Rahman Mohammad Arifur, Mahmud Hasan Tuhin, Sayeed Md. Delwar Hosen and M. A. B. Barkotulla
2.36-2.48	11061	Social Entropy: An Alternative Approach to Redress Social Disorderliness and Chaos in The Light of Global Warming	S.K. Acharjee, M. M. Adhikary and Tanushree Dutta
2.48-3.00	11154	Impacts of Climatic Change on the Human Settlement and Their Possible Adaptation Measures	Sajid Noor and Munazza Fatima
3.00-3.12	11163	Human Impact on Climatic Change and its Adoptive Measures Through Social Mitigation in Pakistan	Sana Arshad and Asad ali khan
3.12-3.24	11207	Role of Muda Irrigation Scheme in Reducing Poverty among the Farmers in Malaysia: Recapitulating Present Situation from Socio-Anthropological Perspective	A.H.M.Zehadul Karim and Md. Sayed Uddin
3.24-3.30	Open discussion		

Refreshment: 3.30-3.45 PM

### Main Conference Room (2<sup>nd</sup> Floor)

Session 2A: Climate change and Agriculture-A

Session Chair: Prof. M. Sohrab Ali, Dean of Agriculture, University of Rajshahi, Bangladesh

Time: 3.45-5.15 PM

Time	Abstract No.	Title	Authors
3.45-3.57	11221	Effect of thermal Environment on Growth and Yield of Black Cumin ( <i>Nigella sativa</i> L.)	C. Majumder, A.Pariari, G.Saha and S.Khan
3.57-4.09	11166	Prediction of Black rot Disease Progression of Cabbage Based on Weather Parameters	S. Dutta, G, Thapa, A. Roy Barman and S. Hembram
4.09-4.21	11091	Impact of Climate Change on Agriculture and Food Security in Bangladesh	Ahmed, H. P <sup>a</sup> and Parven. A
4.21-4.33	11174	Varietal Screening and Epidemiology of Mango Bacterial Canker Disease (MBCD) Under West Bengal Condition	S.K. Ray, S.Dutta, N.Hossain And S.Jha
4.33-4.45	11102	Effect of Composted Sewage Sludge and Cow Dung on Boro Rice in Pot Experiment	M. S. Hossain, K. M. Khalequzzaman, M. A. Sattar and M. W. Zaman
4.45-4.57	11100	Management of Anthracnose Disease of Country Bean for Safe Fresh Food Production	K. M. Khalequzzaman
4.57-5.09	11130	Phenological Development, Growth and Yield of Lentil Genotypes under Prevailing Temperature at Varying Sowing Time	M. A. K. Mian and M. R. Islam
5.09-5.15	Open discussion		

Refreshment: 3.30-3.45 PM

**Dean's Conference Room (1<sup>st</sup> Floor)**

Session 2B: Climate change and Agriculture-B

Session Chair: Prof. Md. Zahidul Hassan, Dean of Life and Earth Science

University of Rajshahi, Bangladesh

Time: 3.45-5.15 PM

Time	Abstract No.	Title	Authors
3.45-3.57	11126	Climate Change and Agriculture- A Study in Indian Perspective	Alok Chantia, and Preeti Misra
3.57-4.09	11171	The Effects of Global Climate Change on Vegetable Crop Growth, Yield and Quality	Ranjit chatterjee
4.09-4.21	11175	Impact of Climate Change in Indian Horticulture	Suchand Datta
4.21-4.33	11233	Combating Climate Change Impacts in Organic Horticulture-the Indian Context	M. K. Pandit
4.33-4.45	11119	Spatial Analysis of Rainfall Distribution and Its Impact on Agricultural Drought at Barind Region, Bangladesh	A.T.M. Jahangir Alam, A.H.M. Saadat and M Sayedur Rahman
4.45-4.57	11214	Future Impact of Storm Surge Disaster on Agricultural Production in the Polder under Climate Change Context	P. K. Halder and M. R. Rahman
4.57-5.09	11189	Effects of Amines Pretreated on Graft Copolymerization of Acrylic Acid and Methacrylic Acid onto Biodegradable Jute Fiber	M.A. Latif, Md. Ibrahim H. Mondal, M. G. Mostafa and Md. Khademul Islam
5.09-5.15	Open discussion		

**Day -2: December 8, 2010****Main Conference Room (2<sup>nd</sup> Floor)**

Session 3A: Climate change and Agriculture-C

Session Chair: Prof. Dr. Md. Ataur Rahman Khan, Dept. of Zoology

University of Rajshahi, Bangladesh

Time: 9.30-11.15 AM

Time	Abstract No.	Title	Authors
9.30-9.42	11110	Tomato Leaf Curl Disease Severity Under Changing Climatic Scenario.	G. Saha, D. Das, M.K. Nanda A. Pal, S. Gonsalves and S. karmakar
9.42-9.54	11142	Sustainable Nutrient Management in Rice - <i>lathyrus(paira)</i> – Greengram Sequence to Improve Total Productivity of Land Under Changed Climatic Condition of Coastal Areas of West Bengal.	Koushik Brahmachari, Suborna Roy Choudhury, Sruti Karmakar, Shoubhik Dutta and Pooja Ghosh
9.54-10.06	11143	Studies on Flower Production Component of Tuberose as Influenced by Changing Thermal Environment in Gangetic Plains of West Bengal	S.Gonsalves, A.Pal, B.Tamang and G. Saha

10.06-10.18	11157	Influence of Weather Factors on Performance of Important <i>khari</i> Legumes in the Gangetic Alluvial Region	M. K. Nanda, A. K. Mukherjee, G. Saha, M. Nandy and S. Chowdhury
10.18-10.30	11165	Sustaining Crop Productivity through Biovillage Programme under Rice- Potato Based Cropping System in West Bengal	M. De. Roy, A. Hui and L.K.Jana
10.30-10.42	11192	Effect of Abiotic Factors on The Occurrence of Pulse Aphid on Greengram in the Lower Gangetic Plains of West Bengal, India	A. Banerjee and B. Bandyopadhyay
10.42-10.54	11218	Effect of Climate Change on Vegetable Cultivation in North East India	P. Saha, N.R. Das and U. Mandal
10.54-11.06	11088	Farmers' Opinion on Impact of Climate Change on Coastal Agriculture	S. K. Rout
11.06-11.15	Open discussion		

### Dean's Conference Room (1<sup>st</sup> Floor)

Session 3B: Climate Change and its Impact on Soil and Water

Session Chair: Prof (Emeritus) M. Fakhrul Islam, Dept. of Applied Chemistry

University of Rajshahi, Bangladesh

Time: 9.30-11.15 AM

Time	Abstract No.	Title	Authors
9.30-9.45	11051	Natural Removal of Arsenic from water in an Experimental Pond	M. Fakhrul Islam and Shariar Bin Rasul
9.45-9.55	11079	Diurnal Soil Temperature variations as Influenced by Climate	Susanta Kumar De; Sanji Kumar Bauri; D. Mazumder; R. Roy and P. K. Tarafdar
9.55-10.05	11177	Changes of Some Physico-Chemical Characteristics in Hooghly River	Kallol Sarkar and Sipra Biswas
10.05-10.15	11178	Changing Pattern of Turbidity in the River Hooghly: A Signature of Climate Change	Sipra Biswas and Kallol Sarkar
10.15-10.25	11173	Dynamics of Cadmium and Lead in Some Soils of Chittagong	M. G. Kibria, M. J. Ahammad and K. T. Osman
10.25-10.35	11212	Spatial and Temporal Variations of Arsenic in the Holocene Alluvial Aquifers of Northwestern Part of Bangladesh	A.H.M. Selim Reza
10.35-10.45	11092	Assessment and Treatment of the Pollutants of Tannery Effluents using Physico-Chemical Methods	Manjushree Chowdhury, M.G. Mostafa and Anand Kumar Saha
10.45-10.55	11237	Impact of Groundwater Irrigation and 'North Rajshahi Irrigation Project'-A Development Option for Conjunctive Use of Surface and Ground Water in Barind Area, NW Bangladesh	Chowdury S. Jahan and Quamrul H. Muzumder
10.55-11.05	11066	Development of New Effluent Treatment Plant (ETP) on Dyeing and Textile Wastewater Treatment for the Protection of CH <sub>4</sub> Gas Emission to the Atmosphere	M. Shohidullah Miah, MA Rahman, Razaul; Rajib Kumar Roy and MA Miyan
11.05-11.15	Open discussion		

Refreshment: Time: 11.15-11.30 AM

**Main Conference Room (2<sup>nd</sup> Floor)**

Session 4A: Climate change, Culture, Society and Education

Session Chair: Prof. Marinova, Murdoch University, Australia

Time: 11.30 AM -1.00 PM

Time	Abstract No.	Title	Authors
11.30-11.40	11230	The Possible Certainness of Culture: Beyond the Biological Explanations of Epidemiological Disease Among Indigenous Population of Formosa Province (Argentina)	Anatilde Idoyaga Molina
11.40-11.50	11244	Why Bangladesh is Always Flooded?: Critical Reflections on the Image of South Asia in Geography Curriculum and Textbooks	Hakhee Kim
11.50-12.00	11240	Spatial Cultural Heritage of Pulau Pinang: It's Problem and Prospect	MJB Moral, Ruslan Rainis, Kamarul Ismail and Abdul Manaf Bohari
12.00-12.10	11115	Environment, the Creator and Destructor of Human civilization	Srimanta Kumar Raut
12.10-12.20	11245	Global Warming and the Bogey of Noah's Deluge in Bangladesh	Md. Abdur Rahman
12.20-12.30	11105	Climate Change Awareness among Higher Secondary Level Students: A Study in Tangail District	S.A. Mamun, M. H. Rahman, A. S. M. Faysal, S. Yasmeen and M. Kar
12.30-12.40	11200	Revitalising the Vistas for Combating the Climate Change in the Third World Countries	K. Pradhan
12.40-12.55	11249	Disaster and Development Linkage: Role of Education and Research	Mahmudul Islam
12.55-1.00		Open discussion	

Refreshment: Time: 11.15-11.30 AM

**Dean's Conference Room (1<sup>st</sup> Floor)**

Session 4B: Climate change, Human Health and Disaster Management

Session Chair: Prof. Fazlye Faruque, Mississippi State University, USA

Time: 11.30 AM-1.00 PM

Time	Abstract No.	Title	Authors
11.30-11.45	11129	Extraction and Detection of Some Essential Amino Acids from <i>Perionyx excavatus</i>	M. Azad, M. S. Jahan. and M.R. Rahman
11.45-12.00	11180	Older Persons and Disasters: Challenges and Opportunities	A. S. M. Atiqur Rahman
12.00-12.15	11181	Situation of Women in Disaster Affected Coastal Areas of Bangladesh	Niger Dil Nahar
12.15-12.30	11078	Environmental Impact Assessment of Farakka Barrage on Padma River, Bangladesh	Md. Moshir Rahman and Md. Redwanur Rahman
12.30-12.45	11215	Sustainable Adaptation to Climate Change and Disaster Risk Reduction	Saadia Majeed
12.45-1.00	11183	Economic Vulnerability of Disaster in Land Productivity: A Case for Mongla Upazila, Bagerhat, Bangladesh	Md. Mujibor Rahman, Mahabub-Ur-Rahman and Mahmudul Islam

Lunch: Time: 1.00-2.00 PM

**Main Conference Room (2<sup>nd</sup> Floor)**

Session 5A: Technological Mitigation of climate change impact-A

Session Chair: Prof. Gregore Falk, Freiburg University of Higher Education, Germany

Time: 2.00-3.30 PM

Time	Abstract No.	Title	Authors
2.00-2.15	11104	Carbon Sequestration Potential of Bamboos <i>Vis-À-Vis</i> Fast Growing Tropical Trees	Sanjay Singh, R. S. Prasad, Srikanti Kumari, S. P. Mishra and R. Das
2.15-2.30	11097	Carbon Sequestration Potential In Aboveground Biomass of Sinharaja Tropical Rain Forest Sri Lanka	D.P. Kumarathunge, P. S. Pathinayake, R. O. Thattil and S. P. Nissanka
2.30-2.45	11147	Potential Health Effects of Climatic Change and their Possible Mitigation Strategies	Munazza Fatima and Adila Shafqat
2.45-3.00	11103	Convalesce the Forest – to Combat Climate Change	Radha Priya P., Ramachandran A. and Malini.P
3.00-3.15	11114	Heat Waves Decrease the Work Efficiency and Deteriorate the Health Status of Labourers Employed in Construction Sectors: A Case Study to Evaluate the Impact of Thermal Extremes, a Climatic Variable on Human Health.	S. Cahtterjee. K. Sarkar, T. Tarafder, S. Sahu and G. Paul
3.15-3.30	11156	Climate Change, Technology Transfer and Intellectual Property Rights	Saswat Subasit

Lunch: Time: 1.00-2.00 PM

**Dean's Conference Room (1<sup>st</sup> Floor)**

Session 5B: Climate change and Biodiversity

Session Chair: Prof. M. Sarwar Jahan, Institute of Environmental Science

University of Rajshahi, Bangladesh

Time: 2.00-3.30 PM

Time	Abstract No.	Title	Authors
2.00-2.12	11226	Status of Composting in India – An Indian Earthworm's Eye-view	Sultan Ahmed Ismail, Priscilla Jebakumari and Dhakshayani, C.
2.12-2.24	11122	Vegetation Analysis of A Newly Formed Island in (Indian) Sunderbans Affected by Cyclone 'Aila' -A Case Study	S.Saha, P.Mandal and M. K. Barai
2.24-2.36	11124	Climate Change and the Crisis of Biodiversity- Changing Life of the Tribal People:A Micro Studu on the Lodhas And The Santals of Paschim Midnapur	Samita Manna

2.36-2.48	11160	Impact of Global Climate Change on the Diversity of Flora and Fauna of the East Kolkata Wetlands, W.B., India	S. Guchhait, S. Kundu, and C.K. Manna
2.48-3.00	11202	Monitoring and Predicting Vegetation Cover Change at Species Level in A Changing Climate Scenario: A Case Study of the Sundarbans	Md. Shafiul Alam, Manoj Kumer Ghosh and Chandan Roy
3.00-3.12	11141	Algal Symbionts Increase DNA Damage in Coral Planulae Exposed to Sunlight	Badrin Nesa, Andrew H Baird, Saki Harii, Irina Yakovleva and Michio Hidaka
3.12-3.24	11242	Impact of Climate Change on Ecosystems	M. Mizanur Rahman, Khairulmaini Osman Salleh and AHM Zehadul Karim
3.24-3.30		Open discussion	

Refreshment: 3.30-3.45 PM

### Main Conference Room (1<sup>st</sup> Floor)

Session 6A: Technological Mitigation of Climate Change Impact-B

Session Chair: Prof. A.H.M. Zehadul Karim, International Islamic University, Malaysia

Time: 3.45-5.00 PM

Time	Abstract No.	Title	Authors
3.45-4.00	11098	Assessment of Changes of Dry Season Floodplain Beel Areas under Climate Variability for Sustainable Agriculture and Fisheries Resources Management using GIS and Remote Sensing Technique	Motaleb Hossain Sarker, Md. Sirajul Islam and Hasibur Rahman
4.00-4.15	11085	Improving Productivity and Sustainability in Warmer Areas Through Resource Conserving Technologies: Save Environment and Reduce Global Warming	M. Ilias Hossain, M. H Ullah, J. M Duxbury J. Lauren and M.I. Hossain
4.15-4.30	11094	Call for Wetland Conservation against Changing Climate	Sridevi, M., Ramachandran, A. and Malini, P.
4.30-4.45	11203	Protected Vegetable Cultivation Technology to Offset Climate Change	J. C. Jana and R. K. Sarkar
4.45-5.00	11211	A Composite Photocatalyst for Methylene Blue Degradation under Visible Light Irradiation	M. Maria Rahman, A.J.F. Samed, Mohammad Afsar Uddin, Ayesha Siddiqua and M. A. Hasnat

Refreshment: 3.30-3.45 PM

**Dean's Conference Room (1<sup>st</sup> Floor)**

Session 6B: Climate change and Agriculture-D

Session Chair: Prof. S.K. Rault, Kolkata University, India

Time: 3.45-5.15 PM

Time	Abstract No.	Title	Authors
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2.12-2.24	11059	Climate Change Impact in the Population of Lady Bird Beetle on Vegetable Crops and Harmful Effect of Insecticides	Sunil Kr. Ghosh, and G. Chakraborty
2.24-2.36	11111	Studies on Seed Priming, Row Spacing and Foliar Nutrition in Chickpea under Rainfed Conditions in West Bengal, India	M. K. Bhowmick, P. K. Biswas, M. C. Dhara, C. Kundu, P. Sen and P. Bhattacharyya
2.36-2.48	11112	Effect of Basal Fertilization and Foliar Nutrition on Growth, Nodulation and Seed Yield of Lentil ( <i>Lens culinaris</i> Medikus) in West Bengal, India	P. K. Biswas, M. K. Bhowmick, P. Sen P. Bhattacharyya And G. C. Malik
2.48-3.00	11128	Climate Change and Salinity in Bangladesh: Constraints and Management Strategy for Crop Production	M.S. Uddin, M.S. I. Khan, M.M.R. Talukdar, M. I. Hossain and M.H. Ullah
3.00-3.12	11234	Has Erythrina Gall Wasp ( <i>Quadrastichus erythrinae</i> Kim.) Become Invasive to Non-native Regions in Response to Recent Climate? A Review	B. K. Das and B. Talukdar
3.12-3.24	11121	Effect of Direct and Derived Temperature Variables on Anthocyanin Content of African Marigold ( <i>Tagetes erecta</i> Linn.) cv. Siracol.	P. Pal, A. Mandal (Khan), P. Ghosh and A. Saha
3.24-3.30		Open Discussion	

## List of Poster Presentations

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2	11068	Livelihood Pattern and Adaptation Strategies of Char People: A Case Study of Kaoakola Union of Sirajgonj District	K. M. Rezaul Karim
3	11076	Earthworms the Resources of Natural Medicine: A Clinical Study on Rheumatic Fever Patients	Md. Sarwar Jahan, Md. Mijanur Rahman and Md. Redwanur Rahman
4	11077	Biochemical Analysis of Earthworm Tissues: An Initial Attempt in Searching Natural Remedy for Rheumatic Fever	Md. Sarwar Jahan, Md. Mijanur Rahman and Md. Redwanur Rahman
5	11086	Hydrochemistry of Ground Water in Rajshahi City, Bangladesh	S.M. Helal Uddin, M.G. Mostafa and A.B.M.H. Haque
6	11087	The Potentiality of <i>Trichoderma</i> Strains for Bioconversion of Municipal Solid Organic Waste	Md. Aminul Islam, M.G. Mostafa and R. Rahman
7	11089	Causes and Effects of Land Use Changes in the Coastal Areas in Bangladesh: a Man-Made Disaster	Asib Ahmed and Md. Abu Hassan Faruk
8	11104	Carbon Sequestration Potential of Bamboos Vis-a-Vis Fast Growing Tropical Trees	Sanjay Singh, R. S. Prasad, Srikanti Kumari, S. P. Mishra and R. Das
9	11109	Impact of Some Weather Parameters on Productivity of Paddy in Howrah District of West Bengal, India	K. Mukhopadhyay, A. Banerjee, S. Murmu, S. Banerjee, K. Nag and B. Sarkar
10	11113	The Consequences of Climate Change for Precipitation Trends in Bangladesh	Mohammad Shohrab Hossain Sarker, Grant Bigg and Juergen Zimmerer
11	11123	Climatological Classification of Bangladesh	Keka I. A., Rahman M.M. and Matin I.
12	11125	Extent and Severity of Groundwater Arsenic and Salinity Contamination and Its Environmental Impact in Southwest Coastal Area (Shyamnagar Thana) of Satkhira District, Bangladesh	S.M. Shafiuzzaman

13	11132	Aerobic Biological Treatment of Industrial Wastewater	Mohammad Zakir Hossain Khan and M. G. Mostafa
14	11135	Assessing the Species Contribution to Aboveground Biomass in a Tropical wet Evergreen Forest in Sri Lanka	M. D. P.Kumarathunge and M. C. M. Iqbal
15	11139	Climate Change: River Morphology and Local Indigenous Adaptation Technique in Jamuna River	Mahmud Hasan Tuhin , Rahman Mohammad Arifur, Md. Mosiur Rhaman and Rahman Md. Munsur
16	11145	Synthesis and Characterization of Cellulose Acetate from Environmental Pollutants Cellulosic Wastes of Textile Industry	A. B. M. Fakrul Alam and Md. Ibrahim H. Mondal
17	11149	NGO, Climate Change and environmental Politics in Bangladesh	Fowzia Gulshana Rashid Lopa
18	11158	Fish Species Dynamics in Brush Cum Vegetation Park ( <i>Katha</i> ) Fishery of Roktodoha Beel	Md. Amimul Ehshan and Abdus Salam Bhuiyan
19	11170	Comparison of yield Performance of Hybrid and Inbreed Rice Varieties under Different Level of Intermittent Irrigation	Sheikh Helena Bulbul, Md. Safinur Rahman and Md. Redwanur Rahman
20	11172	Influence of Atmospheric Temperature on Flower Production of Tuberose ( <i>Polianthes tuberosa</i> L.) in West Bengal	S.Gonsalves, A. Pal ,B.Tamang and G. Saha
21	11182	Agricultural Adaptation due to Salinity Intrusion in the South-Western Coastal Region of Bangladesh	Md. Mujibor Rahman and Nusrat Jahan
22	11186	Recovery of Raw Materials and Development of Waste Management in Penicillin Drug Industries to Reduce the Environmental Pollution	A.T.M. Kamrul Hasan, Md. Abul Kalam Azad, Anjon Kumar Mondal, A.H.K.M. Kamruzaman and Mst. Roksana Khatun
23	11191	A Study on Different Impacts of Climate Change in Bangladesh	M. Jahangir
24	11193	Climate Change Induced Impact on Traditional Agricultural Practices on Chars of Jamuna River	Rahman Mohammad Arifur and Rahman Md. Mansur
25	11204	Electrocatalytic Reduction of NO <sub>2</sub> <sup>-</sup> : Platinum Modified Glassy Carbon Electrode	M.A. Rashed, M. Saiful Alam, S. Hossain and M.A. Hasnat
26	11205	Investigation of Dissimilar Behavior of Ag(poly) and GC(poly) Electrodes Towards the Nitrate (NO <sub>3</sub> <sup>-</sup> ) Reduction	M. Saiful Alam , M.A. Rashed , M.S. Hossain, M. H, M. Karim and M.A. Hasnat
27	11206	Knowledge Attitude and Practices Regarding Pesticide Use in Vegetables Cultivation and Marketing in Bangladesh	Kazi Muhammad Wazir Hyder and Md. Al Mamun Sarkar

28	11208	Participatory Disaster Risk Assessment (A case study of Mongla Upazilla)	A.S.M. Tariqur Rabby and Susmita Sharmin Munia
29	11209	Food Toxicant and Food Adulteration Scenario in Bangladesh	Md. Golam Mustofa, Md. Sarwar Jahan and Md. Moniruzzaman Sarker
30	11210	Influence of Irradiation on Fenton Degradation of Brilliant Red X-3B	M. Afsar Uddin, M. Maria Rahman and M.A. Hasnat
31	11213	Efficient Hydrogen Peroxide Decomposition on Bimetallic Pt–Pd Surface	M.A. Hasnat, M. Maria Rahman, S. M. Borhanuddin, Ayesha Siddiqua, M.R. Karim and N.M. Bahadur
32	11216	Wetlands of Dhaka City: Its Changes, Environmental Consequences and Government Management Policy	Shahabuddin, A.K.M and Raquib Ahmed
33	11217	Changing Pattern of Land use and Environmental Impact of Dhaka City	Md. Shahidul Islam and Raquib Ahmed
34	11220	Effect of Elevated Temperature and CO <sub>2</sub> on Yield and Nutritional Quality of Tomato ( <i>Solanum lycopersicum</i> )	N.R. Das, A. Chaudhary, S.D. Singh and P. Saha
35	11236	Vulnerability to Climate Change Induced Cyclone and Storm Surge in Coastal Bangladesh: What Determines Post-Cyclone Household Food Insecurity?	Shitangsu K Paul, Jayant K Routray and Shafiu Alam
36	11238	Trends in Maximum Temperature and its Impact on Thunderstorm Frequency During the Pre-monsoon Season in Bangladesh	Samarendra Karmakar and Md. Abdul Mannan
37	11246	Assessing Adaptation to Gender Vulnerabilities Due to Natural Disaster - A Study on South West Coastal Bangladesh	Md. Mujibor Rahman, Md. Abdus Salam and Mahmudul Islam
38	11247	Strategic Environmental Assessment (SEA) on Climate Change Adaptation and Disaster Risk Reduction Plans and Programmes in Kurigram District in Bangladesh	Md. Mujibor Rahman, Md. Nazmul Hoque Sumon and Mahmudul Islam
39	11248	Impact of Aila on Agriculture and Livelihood in the Southwestern Coastal Region of Bangladesh	Md. Mujibor Rahman, Rehana Parvin and Md Ashrafu Alam

## **Editorial**

The impacts of climate change have consistently been appearing on top of the international policy agenda and news headlines. A vast body of literature developed on exploring the consequences of climate change on human societies. The potential security implications of climate change are appeared to be few areas which have drawn substantial attention by scientists and policy makers across the world. The applied definition of security is of course not fully explicit. It ranges from impacts on food security and vulnerability to disasters in one extreme to increased risk of international armed conflict and terrorism at the other.

The vast majority of international scientists and peer-reviewed reports affirm that climate change is a serious growing threat, leaving no country unaffected, even though some countries are wealthy and immuned from the pressure of extreme weather events and possible threat of sea-level rise. Scientists strongly predict that this will occur, unless immediate action is taken. It may be possible to significantly reduce anthropogenic emissions of carbon dioxide and other greenhouse gases those are currently on rise. We have to settle down on a strategy how to mitigate climate change impact on our life. So it is very naturally a great challenge how to improve the condition of energy security and optimize technological modernization, economical growth and exploitation of natural resources in an environment friendly way. Development of clean, climate-friendly energy technologies will provide new business opportunities and new avenues of prosperity for both developed and developing countries equally. As the causes of climate change are global, the challenge could only be faced through global partnership. The policies and politics involved are different, but not difficult to reach a reasonable target if sincere efforts are made.

Bangladesh is considered as the most threatened country in the world referring climate change impact. The entire world is now positively conscious about the potential threat that is going to affect almost each and every parts of the planet in different magnitudes and in different dimensions. The global threat sea-level rise is estimated to displace about one-third of the population of Bangladesh, if it rises more than 3 meters from present average sea-level. Multiplied impacts are going to affect different aspects of the country such as food security, human health, loss of bio-diversity etc. The seminar intends to address certain selected aspects which are imminent, burning and yet to be decided appropriately to outline a strategy, and to show how and where we can work together to tackle the problem at this juncture of 21<sup>st</sup> century. During the last several world congresses the national leaders have perpetually been unsuccessful due to misunderstanding of three things. First is the reason of crises, the second one is the depth and dimension of the effect and the third one is the possible way of solution. The proposed seminar is a small effort to unite ideas and concepts to open up a path for better understanding of these three misunderstood goals. The seminar is expected to provide an opportunity to discuss current environmental issues, promote greater collaboration and strengthen the connection among scientists, policy makers and practitioners. Institute of Environmental Science (IES) at the University of Rajshahi in Bangladesh has organized this seminar on Climate Change and Environmental Challenges targeting our responsibilities at the beginning of the 21<sup>st</sup> Century with the following major objectives.

- evaluate and review environment at national, regional and global levels to:
- evaluate the causes and effects of environmental degradation
- discuss research finding and share knowledge and information on environmental issues due to climate change
- to explore the use of new technologies and scientific knowledge in the study of environmental science
- to provide opportunities for decision makers, scientists, trainers and experts to share their expertise

We sincerely hope that this seminar will go a long way in future with its visions and contributions.

## **Editors**

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# Oral Presentations

**Keynote Abstract: 00001**

**HUMANISTIC SUSTAINABILITY EDUCATION : PREPARING STUDENTS  
FOR A BETTER WORLD**

**Dora Marinova and Talia Raphaely**

Curtin University Sustainability Policy (CUSP) Institute  
Curtin University of Technology  
GPO Box U 1987, Perth WA 6845, Perth  
E-mail: D.Marinova@curtin.edu.au

Sustainability education is emerging as a complex area which needs to respond to pressing global challenges related to the compounded effects of human behaviour and actions on the planet, such as climate change, loss of biodiversity, socially just resource distribution and improving the quality of life of the needy. It has to prepare students to feel empowered to challenge the current system and create a world that better represents their dreams for the future. This however is not an easy task as sustainability requires a paradigm shift in people's thinking as well as to unteach unsustainability, shape the educational area of this new subject and set up students and teachers for a life-long journey.

This paper analyzes the policy frameworks and educational discourses that have informed sustainability education, namely humane education, environmental education, ecopedagogy, education for sustainable development, education for a culture of peace and sustainability, participatory education and humanistic education. The educational approach used by the authors, termed humanistic sustainability education, is then described. It draws on all of the above discourses as well as on the science of acting in order to create, as demonstrated by the case studies, positive hope-based actions by students with the vision and skills to create a better world.

**Abstract: 11225**

**CLIMATE CHANGE IN ICELAND**

**Gregor C. Falk**

Department of Geography, University of Education Freiburg, Germany  
Email: [gregor.falk@ph-freiburg.de](mailto:gregor.falk@ph-freiburg.de)

Iceland's landscape had been shaped and is still modeled by numerous plateau and outlet glaciers. As dynamic systems these glaciers show intense fluctuations due to variations in changing global and local climate patterns. Comparing satellite images, older topographic maps and observations on the ground provide detailed information about various oscillations during the last 150 years. One overall trend, as in many other glaciated regions, is retreating of the ice and mass loss since

the end of the Little Ice Age. Only short periods show different developments. Interestingly glaciers in Norway do not follow this trend but slightly increased their mass volume. The sedimentary developments around Fjallsjökull and Morsdalsjökull are two examples which are shown and discussed in the presentation.

**Abstract: 11224**

### **CLIMATE CHANGE IN THE ALPS**

**Lieber Herr Falk and Johannes Bertsch**

University of Education Freiburg, Germany

The Alps as a mountain region in the heart of Europe are heavily used by tourism industry and by traffic lines. That is why every year millions of Euros are spent for protection against the consequences of melting permafrost and against impacts of avalanches all over the Alps.

So the danger of natural hazards is an important reason for analyzing changes of climate and nature. The lecture will deal with these changes in the area of the Alps. The point of main emphasis is the correlation of climate change with the occurrences of avalanches in this area.

**Abstract: 11235**

### **TREND IN RAINFALL AND ITS RELATION WITH THUNDERSTORM FREQUENCY DURING THE PRE-MONSOON SEASON IN BANGLADESH**

**Samarendra Karmakar**

Bangladesh Meteorological Department, Dhaka, Bangladesh

Email: [skarmakarsmrc@yahoo.com](mailto:skarmakarsmrc@yahoo.com)

Rainfall is one of the important climatic elements, which has changing patterns globally, regionally and locally. It has also variability with time: annually, seasonally or monthly, having important implications in agriculture. In this paper, attempts have been made to study the trends in monthly and seasonal rainfall at 27 stations over Bangladesh during the pre-monsoon season using the data of the period 1980-2008. It has been found that the monthly and seasonal rainfall has decreasing trends in all the divisional headquarters of Bangladesh and the trends are not statistically significant. The monthly and seasonal rainfall has mainly decreasing trends with some exceptions during the pre-monsoon season in Bangladesh. Some trends are statistically significant at 95% level, some are significant at 100% level and some are not significant. The spatial distribution of rainfall trends reveals that maximum decreasing trends of monthly as well as seasonal temperatures lie over the Faridpur-Dhaka-Chandpur-Patuakhali-Sandwip region and

northeastern part of Bangladesh .and maximum increasing trends over the extreme southeastern part of the country. The trend in country-averaged seasonal rainfall during the pre-monsoon season has clear decreasing trend at a rate of -42.051 mm/10 years and this trend is not statistically significant

Attempts have also been made to study the trends in monthly and seasonal frequency of thunderstorm during the pre-monsoon season of 1980-2008. It has been found that the monthly and seasonal thunderstorm frequency has decreasing trends at most places of Bangladesh except in May when there are increasing trends at many places. The country-averaged seasonal thunderstorm frequency has decreasing trend at a rate of -1.6/10 years but the rate is not statistically significant.

From the study of correlation of rainfall with frequency of thunderstorms, it is found that the monthly and seasonal rainfalls are positively correlated with the monthly and seasonal frequency of thunderstorms. This means that the monthly and seasonal rainfalls during the pre-monsoon season in Bangladesh are likely to decrease with the decrease of monthly and seasonal thunderstorm frequency.

The correlation co-efficient of country-averaged seasonal rainfall and the country-averaged seasonal thunderstorm frequency during the pre-monsoon season of 1980-2008 has been found to be 0.758802, which is statistically significant at 95% level. The spatial distribution of the correlation coefficients reveals that the monthly and seasonal correlation coefficients are maximum over the northeastern and southwestern parts of Bangladesh and minimum over the southern part of the country, except in March when there is also maximum correlation coefficient over the southeastern part of Bangladesh.

**Abstract: 11053**

**LAND USE CHANGE IN ARID REGION: DIMENSIONS IN PROCESS AND MODELING THE PREDICTION OF DESERTIFICATION USING REMOTE SENSING AND GIS**

**Raquib Ahmed<sup>1</sup>, Mohammad Arshad<sup>2</sup> and Bao Anming<sup>3</sup>**

<sup>1</sup>Institute of Environmental Science, University of Rajshahi, Bangladesh

<sup>2</sup>Cholistan Institute of Desert Studies, The Islamia University of Bahawalpur, Pakistan

<sup>3</sup>Institute of Ecology and Geography, Chinese Academy of Sciences Urumqi, China

Land use is a dynamic phenomenon of human–nature interaction which usually reflects the status of environment of that place. The total synthesis is developed by a wide range of influencing factors. The changing scenario of the Cholistan Desert in Pakistan is influenced (i) by the topography including vegetation, (ii) by the human economic practices such as cattle rearing, and

(iii) by infrastructure development required by population settlement and partly by agriculture. The northern part of the desert, which is mixed with some level of vegetation growth and patchy desert agriculture, attracts more pasture activities appear to instigate desertification process. Present study attempts to investigate on the general land cover/land use change in the Cholistan desert, model the land use change with special reference to desertification process and predict the change in short and in long term time phase using multi-layer perception (MLP). The study also revealed that the impact of the presence of different types of influencing factors played a significant role in directing spatial change pattern.

**Abstract: 11243**

**IMPACT OF CLIMATE CHANGE ON THE SEASONAL PATTERN OF  
BANGLADESH: A CASE STUDY OF THE GREATER RANGPUR DISTRICT**

**Md. Zakaria Hossain<sup>1</sup>, Md. Jahanur Rahman<sup>2</sup> and Md. Abul Kalam Azad<sup>3</sup>**

<sup>1,3</sup>Institute of Environmental Science, Rajshahi University, Bangladesh  
E-mail: akazad\_ies@yahoo.com

<sup>2</sup>Department of Statistics, Rajshahi University, Bangladesh

Bangladesh is an agricultural country, where seasons mainly determine the cropping pattern and its production. Any change of seasonal pattern due to climate change would have profound effect on the agricultural system of Bangladesh. To observe the seasonal changing pattern, 54 years data of temperature and rainfall for greater Rangpur district was collected from the Bangladesh Meteorological Department, Agargaon, Dhaka. The data was categorized into three groups: pre-liberation year (1955-1972) and post-liberation years (1973-1990 and 1991-2008). The average data of temperature and rainfall during these periods was calculated according to seasons (Summer, Rainy, Autumn, Late Autumn, Spring and Winter). From the analysis of these data, it was found that temperature of Rangpur district affected by the global climate change. Temperature during the post-liberation periods (1975-1991 and 1992-2008) was higher than the pre-liberation year (1958-1974) period. However, a low rainfall in summer and an increasing trend of rainfall in winter were observed in the study area. Therefore, it can be concluded that climate change have visible impacts on the temperature and rainfall pattern as well as the seasons of Bangladesh.

**Abstract: 11229**

**ENVIRONMENTAL IMPACT OF OPENCAST COAL MINING:  
A CASE STUDY OF PHULBARI, DINAJPUR**

**E. Haque<sup>1</sup> and A.K Azad<sup>2</sup>**

<sup>1</sup>Research Fellow, Institute of Environmental Science, Rajshahi University, Bangladesh  
E-mail: e\_haque27@yahoo.com

<sup>2</sup>Professor, Environmental Science Discipline, Khulna University, Bangladesh.

Coal being a primary source of energy, plays a vital role in an energy- intensive economy. Opencast mining results in extensive damage to the environment. Even though the method adapted for mining is often selected according to the characteristics of the coal seam geo-mining conditions of late political and social considerations have began to exercise greater influence in the late choice of mining method. Mining results in severe damage to land quality, air, health and agriculture. The impact of mining on the environment largely depends on method of mining adapted, the geo-mining condition of the location and the size and duration of the mining operation. The aims of the work are to help in environmental management study for phulbari opencast coalmining problem. To provide knowledge to rural people, environmentalist and transport planners. To provide knowledge to compensate of environmental impacts in that region to develop a comprehensive action plan for proper management and improvement environment.

Although Bangladesh would be made significant economic progress in recent years, air pollution continues to be the most visible environmental problem and imposes significant health and economic costs on society. The socio-economic and agricultural impacts of the mine were evaluated through a questionnaire survey. From the data analysis it is showed that the agricultural loss would be TK 4209.62 million and economic loss due to revolts and infrastructure destruction would be TK 1157.67 million. An evaluation of economic loss due to adverse health impacts of PM<sub>10</sub> was also performed by using Ostro (1994) model. Using data on pollutant concentration and population for 2006, the study estimated that the number of excess death per annum due to PM<sub>10</sub> pollution in the study area would be 547 and this value is TK 2.9 billion. Value of statistical life and benefit transfer are used to obtain the unit value of health effects.

**Abstract: 11095**

**RECENT CLIMATE CHANGE TREND ANALYSIS AND FUTURE PREDICTION  
ON OLD BRAHMAPUTRA RIVER, BANGLADESH**

**Md. Rubayet Mortuza, Golam Arif Rabbani and Umma Salma Rashid**

Department of Civil Engineering, BUET, Dhaka 1000

Email: antu\_ce@yahoo.com

The real weapon of Mass Destruction and main environmental challenge humanity is facing today is Climate change. All the achievements of human beings are overshadowed by the ominous outlook envisaged by the consequences of climate change in the form of increase in global temperature, melting of glacier, rise of extreme events like cyclone and flood, aggravated desertification and erosion as well as irreversible changes in ecosystems and biodiversity. Due to climate change rivers on every continent are drying out, threatening severe water shortages. According to the WWF report, World's top rivers are at risk (March, 2007). Five of the ten rivers listed in the report are in Asia. The impact of climate change on Bangladesh is becoming more visible day by day as many things are often found unusual than the previous. Changes in average temperature, precipitation, evaporation caused by the climate change are very likely to affect the rivers of Bangladesh. This study aimed at statistical analysis of the recent observed trend of water level, precipitation, evaporation and prediction of future scenarios with Global Climate Models (GCMs) on Old Brahmaputra River.

**Abstract: 11225**

## **CLIMATE CHANGE RHETORIC IN BANGLADESH: A CURSE OR A BLESSING?**

**Amzad Hossain and Dora Marinova**

Curtin University Sustainability Policy (CUSP), Institute Curtin University of Technology  
GPO Box U 1987, Perth WA 6845, Perth, E-mail: A.Hossain@curtin.edu.au

Diverse views about the impacts of climate change on Bangladesh warrant an assessment of how to address its consequences. Climate change is a global phenomenon but its implications are distinctively local.

The rhetoric about climate change in Bangladesh is diverse. First, there is the scientific evidence and projections derived from the IPCC Fourth Assessment but there are also the local and regional perspectives. Bleak scenarios are being created about Bangladesh's future. Some hold the view that human induced global warming will cause significant sea level rise and the coastal area of the country, representing 25% of its territory, will sink. Second, others project that India's continuous unilateral withdrawal of the Ganges water in the summer will continue to cause increasing desertification in the west half of the country. The morally bankrupt governance of the country is being blamed for its incapacity to fruitfully address the water sharing problem with India by undertaking all possible measures (including international negotiations) to solve it. Thirdly, those who are religious and spiritual at heart, see climate change as a result of people's transgression of nature's limits in social, economic and environmental sustainability capacity.

Are all of these scenarios equally threatening and challenging? How are people responding to them? The first two views are directed to blame the non-locals while the third view blames the country itself.

Yet, there exists the fourth view maintained by innately naturalists, such as Baul-philosophers, who acknowledge all natural phenomena as the act of Nature/Creator and essentially sustainability-positive. This view is uniting all views and hugely supported by ordinary people.

All these views suggest that people somehow make assessment of the changing socio-economic and environmental circumstances from their respective perceptions. *Climate change is neither a curse nor a blessing, and has positive and negative sides.* A sustainability assessment requires examination of the positive as well as the negative perceptions. The paper analyses the positive perceptions in light of the interpretation they bring towards understanding sustainable development; while the negative ones are assessed in light of what people need to do to address the challenges. Finally diverse social, governmental and non-governmental initiatives are assessed from a policy perspective as to their contribution for climate change adaptation and resilience.

The paper concludes that despite these diverse perceptions and views about climate change, in Bangladesh people should continue to address its implications within a sustainable development framework and without attempting to technologically dominate nature.

**Abstract: 11116**

**PAST AND FUTURE CLIMATIC TRENDS OF PRECIPITATION AND  
TEMPERATURE IN SRI LANKA**

**Anushka Rajapaksha<sup>1\*</sup>, Jayantha Obeysekera<sup>2</sup>, Michelle Irizarry<sup>2</sup>, Ruvini Gunathilake<sup>3</sup>,  
Nelun Fernando<sup>4</sup> and Meththika Vithanage<sup>1</sup>**

<sup>1</sup>Chemical and Environmental Systems Modeling Research Group, Institute of Fundamental Studies, Kandy, Sri Lanka, <sup>2</sup>Hydrologic and Environmental Systems Modeling, South Florida Water Management District, West Palm Beach, Florida, USA, <sup>3</sup>Department of Statistics, University of Peradeniya, <sup>4</sup>Rutgers University, New Jersey, USA, Corresponding author: [upamalirajapaksha@yahoo.com](mailto:upamalirajapaksha@yahoo.com)

Climate change investigations should always be preceded by understanding the trends in historical climatic and other associated environmental data. Historical temperature and precipitation data for 23 weather stations in Sri Lanka with the daily records for the period 1961-2002 have been analyzed for structural changes in statistical characteristics to investigate if there is a consistent regional trend. The statistics analyzed included annual and monthly sums or averages as well as daily extremes of durations ranging from 1 to 7 days.

In this study 20<sup>th</sup> century simulation of GCMs were compared with the historical data to assess the reasonableness of global models in simulating both temperature and precipitation of Sri Lanka. Temperature and precipitation projections of one GCM, NCAR-CCSM3 model, were also analyzed to understand the future changes that could be expected for various parts of Sri Lanka. The grid cell nearest to each of the 23 meteorological stations was selected for this trend analysis.

Six of the long-term meteorological stations (Bandarawela, Diyatalawa, Jaffna, KKS, Mullaitivu, Pottuvil) were eliminated from the analysis due to the presence of major gaps in the records. Fifteen out of the remaining 17 stations showed statistically significant trends (at 5% level) in annual average temperature and the median trend magnitude was about 0.18 degrees Celcius per decade with a maximum of 0.35 degrees Celcius observed at Ratmalana station. Generally, at all stations, the positive temperature trends for all months, and the daily maximum and minimum temperature were statistically significant. However, only 3 out of 17 stations showed a statistically significant trend for precipitation and the magnitude of the trends was all negative (decreasing precipitation) at all stations. The trend magnitude at those three stations ranged from about -140 mm/decade to about -68 mm/decade. Unlike for temperature, this study could not conclude that there was a consistent historical trend in precipitation across all of Sri Lanka.

For both temperature and precipitation, a comparison of 20<sup>th</sup> century data for the GCMs with those of the historical data showed that the GCMs had a consistent bias. However, when

corrected for bias, generally the trends in both historical data and GCM data were similar for most locations. The projections from the NCAR CCSM3 model showed that by 2060 (50 year planning horizon) the temperature increase is about 2.1 degrees Celcius whereas for 2100 it is about 3.3 degrees Celcius. However, as for historical precipitation, there was no consistent trend in future precipitation. The above findings have the potential to impact future water resource availability of Sri Lanka and further investigation, with more accurate Regional Climate Models will be necessary to fine tune the predictions for specific locations in Sri Lanka.

**Abstract: 11190**

**A CASE STUDY OF WATER USE CONFLICT IN SOUTH ASIA (GANGES-BRAHMAPUTRA- MEGHNA BASIN) AND THEIR PERSPECTIVE IMPACTS ON BANGLADESH**

**<sup>1</sup>Md. Mosiur Rahman, <sup>2</sup>Abu Hena Mostufa Kamal, <sup>3</sup>Rahman Mohammad Arifur, <sup>3</sup>Mahmud Hasan Tuhin, <sup>4</sup>Sayed Md. Delwar Hosen and <sup>5</sup>M. A. B. Barkotulla**

<sup>1</sup>River Research Institute (RRI), Faridpur <sup>2</sup>Department of Civil Engineering, Rajshahi University of Engineering & Technology (RUET) <sup>3</sup>Institute of Water and Flood Management; Bangladesh University of Engineering & Technology, <sup>4</sup>Dept of Chemical Engineering & Polymer Science, Shahjalal University of Science & Technology, <sup>5</sup> Department of Crop Science and Technology, University of Rajshahi, Bangladesh

E-mail: [mosiur26ce@yahoo.com](mailto:mosiur26ce@yahoo.com)

The increasing scarcity of water leads to the desire for control of water resources, which in turn becomes a ground for breeding conflicts. These conflicts are manifested at interstate and intra-state levels. Out of the seven South Asian countries, three, namely Pakistan, Bangladesh and Nepal are involved in water sharing conflicts with India. The need for water is accentuated by the fact that these countries are mainly agrarian economies. These conflicts have not only hampered their economic development at the national level, but the region, as a whole, is not fully benefiting from the process of globalization. Due to geographical and geological settings, Bangladesh is to suffer heavily for spatial and temporal variation. The Indus Waters Treaty (1960) between India and Pakistan is one of the few examples in South Asia. Another recent example in this context is the Ganges Waters Treaty. However, the grievances of contracting parties, lead to the possibility that the present cooperation may turn into a future conflict.

The study was taking into account some of the following question, what are the factors, which can lead to conflicts over water resource sharing particularly when there is scarcity? And what is the existing status of disputes between South Asian States over water sharing and can these be transformed into armed conflicts in future?

It is imperative that water conflict theory be developed in order to promote cooperative and peaceful negotiation between upper and lower riparian states along transboundary rivers. The historical and current relations between India and Bangladesh over the use of the Ganges-Brahmaputra-Meghna delta was discussed as an example of an on going water conflict negotiation. A correlation between water events would have been expected between India and Bangladesh due to the introduction of the Farakka Barrage in and the signing of the 1996 treaty. Giordano and others found that there was a mild correlation between external and internal water events appears dis-synchronous with the South Asia regional setting (2002). It is concluded that the river linking project of India will have adverse impact on the climate, land accretion, soil fertility, drinking water supply, surface water quality, Boro production, waterborne diseases and biodiversity of Bangladesh.

The idea of shared water supply has not been easily understood by the nations of this region. The growing populations come with the increase in demand and could be a catalyst for conflict to arise out of the ethnic and political disputes. Bangladesh is more vulnerable to flood and drought than India because of the Farakka Barrage. Bangladesh government cannot make a plan about its national water resources utilization without considering the effect of the Farakka Barrage.

Present cooperation may turn into a future conflict; in this case we should apply equimarginal principle for River Basin Management. Bangladesh government should make a plan about its national water resources and international rivers may become a ground for breeding disputes among the co-riparian states. This study will begin by examining the contributing factors that are known to increase the likelihood of conflict within a framework of diminishing water security.

**Abstract: 11061**

### **SOCIAL ENTROPY: AN ALTERNATIVE APPROACH TO REDRESS SOCIAL DISORDERNESS AND CHAOS IN THE LIGHT OF GLOBAL WARMING**

**S.K. Acharjee<sup>1</sup>, M. M. Adhikary<sup>1</sup> and Tanushree Dutta<sup>2</sup>**

<sup>1,2</sup>Professor of Agricultural Extension, Faculty of Agriculture, <sup>3</sup>Research Scholar, Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India

When everybody is concerned with global warming and its deleterious impact on agriculture, public health and water scarcity, we can't remain stoic to the more dangerous aspect of social restlessness and entropy and else be branded at "Social Warming". The basic difference between cosmic entropy and social entropy is that for the former there is an inevitable expansion of space to accommodate excess of global warming and for the latter, the social space is constricting every moment to magnify the social dissonance called social entropy. This is becoming hopelessly revealing when the poor rural people are treated as a placid recipient of so called

technology or exotic concept. They are motivated every time and are allowed to go frustrated the next time leaving in between psycho-social entropy. The history of Extension Education in India is inevitably flamboyant with a pro-adoption approach in transfer of technology mode. The much acclaimed Green Revolution in India had been instrumental so far and so on, as some might demand, with transfer of exotic technology, external supply of input and a supply driven knowledge concept. A plethora of extension programs may be bracketed with this so called 'Transfer of Technology' mode. When knowledge is imposed, motivation is imported, and action is imitative, the social outcome is supposed to be an exposition of disorderness / chaos despite of its quantum achievements. The present study is basically a concept paper on Social Entropy, an analogy of Principle of Thermodynamics, has been applied herewith. In a closed system of energy flow, the gap between the work done and energy lost is widening to add to, what we think that, with the increase of gap between motivation unleashed and accomplishment made, the Social Entropy will be increasing. The training and transfer of technology approach in science will be rendered classical and depletive since, it would be adding more exotic capacity without withdrawing systemic and intrinsic disorders. This would invite institutional conflict, organizational disorder, and performance chaos. In 1990, American Sociologist Kenneth Bailey published Social Entropy Theory, a non- equilibrium approach of societal analysis using a mix of Ludwig Bertalanffy's general systems theory, Claude Shannon's entropy, a Rudolf Clausius' entropy. Bailey defines as "isomorphic complex system" as being comprised of human individuals as the components, interaction of these components, and the national (political) border of the country, with the latter serving as a boundary for social interaction. Bailey also included a section titled the "History of Social Entropy", in which he traces the use of Thermodynamics and Entropy in sociology from Pareto to Prigogine to Samuelson and others in literature.

So, the paper is focusing on an alternative paradigm for managing human behavior and organizations, institutions and society through managing entropy by withdrawing disorderness from the system trembling with chaos, conflict, and non-performance.

**Abstract: 11154**

## **IMPACTS OF CLIMATIC CHANGE ON THE HUMAN SETTLEMENT AND THEIR POSSIBLE ADAPTATION MEASURES**

**Mr. Sajid Noor\* and Miss Munazza Fatima\*\***

\*Assistant Professor, Department of Geography The Islamia University of Bahawalpur. Pakistan

\*\*Lecturer, Department of Geography The Islamia University of Bahawalpur. Pakistan

Email: [munazza.fatima@iub.edu.pk](mailto:munazza.fatima@iub.edu.pk)

This paper addresses the impacts of recent climatic change on human settlement and opportunities within settlement for adaptation to climate change. Similarly an attempt will be made to provide an overview of recommendations for expanding the current knowledge base with respect to climate change and human settlements.

Settlements are important in considering prospects for adaptation to climatic change, both because they represent concentrations of people and because building and other infrastructures offers ways to manage risks with climate extremes and other non climatic stressors. Impact of climatic change on human settlement is likely to be especially problematic for vulnerable parts of population like the socioeconomic, age and gender groups and the vulnerable regions like South Asia. Adaptation to such problems change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished including anticipatory and reactive adaptation, private and public adaptation and autonomous and planned adaptation. Mainly, there are two adaptation options to respond to climatic change, one is to contribute to climatic change mitigation strategies, by taking actions to reduce green house emissions and by showing leadership in encouraging these to support such actions. The second response is to consider strategies for adaptation by finding ways either to reduce sensitivity to projected change or to increase the settlements coping capacities.

There are number of suggestions that would help to expand the knowledge base about the linkages between climatic change and human settlements including analysis of vulnerabilities, develop better projections of climatic change, design socially acceptable and practically implemental strategies for climatic change adaptation, and to evaluate and document experiences with settlement climatic change response. While making decision, improved tools and sustainable approaches for infrastructure planning as well as design to reduce exposure and sensibility to climatic change impacts may be given the special consideration. Similarly adaptation can be facilitated by improving societal awareness and preparedness, primarily by education and campaigns.

**Abstract: 11163**

## **HUMAN IMPACT ON CLIMATIC CHANGE AND ITS ADOPTIVE MEASURES THROUGH SOCIAL MITIGATION IN PAKISTAN**

**Sana Arshad<sup>1</sup> and Asad ali khan<sup>1</sup>**

Department of Geography, The Islamia University of Bahawalpur Pakistan<sup>1</sup>

Email: [sanaiub111@gmail.com](mailto:sanaiub111@gmail.com), [asadkhaniub@yahoo.com](mailto:asadkhaniub@yahoo.com)

Natural greenhouse gases hinder the heat radiation back into space in a greater extent as compared to solar radiations striking the earth's surface. This is increasing the global temperature with a fast speed as compared to past. Five gases including water vapors, carbon dioxide, ozone, nitrous oxide and methane have significant role in green house gases emission. Anthropogenic effects are increasing the emission of these gases plus chlorofluorocarbons (CFCs)

at a greater level and impacting Macroclimatic changes. These gases contribute directly to global warming. The emission of green house gases has raised the Wide range of natural climatic variation and long term effects of warming on global and regional level cannot be predicted with certainty, however the mounting evidence that warming is causing changes in position, and intensity of weather system, regional wind, and temperature and precipitation pattern is clear. The green house gas emission is highest in developing countries and in Pakistan is 0.85% per person per year according to International Energy Agency. The increase in GHGs is majorly due to human activities. Mitigation of climatic change affects impact on reducing negative human activities. With the increase in built up area and land use change of the country, human activities are playing major role in increasing GHGs emissions. Paper will investigate major human factors or sources that are increasing the GHGs emissions in Pakistan. The sources includes energy production and use, land use change, industrial activities, municipal wastes, Pollution, increase in particular matter emission etc. The objectives of paper include tracing the mentioned sources in Pakistan as a factor of increasing GHGs emissions. Land use change affects the forest ecosystem. The vegetation or forests capture and store Carbon dioxide making a major contribution to climatic change. Deforestation, destruction and over harvesting have become major sources of Green house gas emissions. Forests and climatic change is very closely linked because of major contribution in microclimatic pattern. Mitigation and adaptation involves development and implementation of techniques and policies ranged from local community level to regional level. The potential of mitigation and adaptation for local community is very large, and ranges from technological, behavioral (altered food and recreation choices), to managerial regarding policies and implementation. Finally, paper will conclude different measures of social mitigation and adaptation by local community that ultimately will reduce anthropogenic affects on climatic change and global warming.

**Abstract: 11207**

**ROLE OF MUDA IRRIGATION SCHEME IN REDUCING POVERTY AMONG THE FARMERS IN MALAYSIA: RECAPITULATING PRESENT SITUATION FROM SOCIO-ANTHROPOLOGICAL PERSPECTIVE**

**A.H.M. Zehadul Karim and Md. Sayed Uddin**

Department of Sociology and Anthropology, International Islamic University Malaysia  
Gombak, Kuala Lumpur, Malaysia, Email: ahmzkarim@yahoo.com

The Muda Irrigation Scheme was established in Malaysia with purpose of achieving self-sufficiency in rice production for domestic consumption as well as to reducing hardship and poverty among the farmers in the project areas. Since its inception in the middle of 1970s, the project had brought a massive change in the agrarian culture of rice producing peasants in

Malaysia allowing them to integrate in the network of a cooperative relationship. For the last three decades, Muda Irrigation Scheme has been recognized by the international communities as the most successful program in agriculture which has been able to increase the increasing the rice productivity and also at the same time reducing poverty of the farmers. We have enough evidences that after the introduction of this scheme, the real income of the farmers had increased by 2.4 times as they introduced double cropping in the project areas (*e.g.* FAO and World Bank 1975). Despite several decades of such remarkable success in agriculture, a few researchers and commentators (*e.g.*, Ramli Mohamad 1988) immediate after its installation, remarked clearly that due to full dependence on technology, many farmers in the Muda areas had lost their tenancy which eventually made them victim of the economic circumstances. They argued that since Farmers' Associations (FAs) are practically controlling the total irrigation system and farming activities in the villages, these FAs have simply appeared as newly-emerged-power bastions, which are fully represented by the middle and rich farmers. These are represented by the influential persons of the locality disbursing a class-based super-ordinate values, norms and cultures of themselves. This paper focuses on the present condition of the farmers through studying a small village from socioanthropological perspective and desires to provide information about the farmers' real situation from genealogical and holistic viewpoint after three decades of glorious continuity of the Muda. More specifically, we want to reveal the poverty situation at the village level in present time, and to analyze it from their cultural context.

**Abstract: 11221**

**EFFECT OF THERMAL ENVIRONMENT ON GROWTH AND YIELD OF BLACK CUMIN (*NIGELLA SATIVA* L.)**

**C. Majumder, A. Pariari\*, G. Saha<sup>1</sup> and S. Khan**

Department of Spices and Plantation Crops, Faculty of Horticulture, <sup>1</sup>Department of Ag. Meteorology and Physics, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur: West Bengal: 741252: India, Email :dranupariari@yahoo.co.in

An experiment was carried out at Horticultural Research Station, Bidhan Chandra krishi viswavidyalaya, Nadia, West Bengal, India during October, 2009 to March, 2010 on black cumin with the following objectives: i. to study the effect of meteorological factors *viz.* temperature, rainfall, relative humidity etc. on growth and productivity of black cumin. ii. to identify the most suitable date of sowing to get the highest seed production under gangetic alluvial plains of West Bengal.

The experiment was laid out in Strip Plot Design with 12 treatments and 3 replications in a plot size of 1.0 x 1.5 m<sup>2</sup>. In this experiment, seeds were sown in 6 different dates i.e. 28-10-2009, 04-11-2009, 11-11-2009, 18-11-2009, 25-11-2009 and 02-12-2009 at 7 days interval with 2 spacings i.e. 15 cm (Row to Row) x 10 cm (Plant to plant) and 20 cm (Row to Row) x 20 cm (Plant to plant). Data on different parameters like growth (germination to pod maturity), meteorology (RH and temperature at different tier of crop canopy) and yield attributes have been recorded during experiment. Based on the results obtained in the experiment it was recorded that the germination of seed was only affected by maximum temperature, minimum temperature and minimum relative humidity; but wind speed and sunshine hour had no effect on it. Similarly, pod maturity was also affected by the sunshine hour. Other phenological factors like days to first leaf, fifth leaf, first flower bud and first pod were not at all affected by any other macro meteorological parameters. Seeds sown in 4<sup>th</sup> November with 20 x 20 cm spacing took minimum time (7.67 days) for germination. Investigation also revealed that the highest plant height was obtained when seeds were sown in 18<sup>th</sup> November with 20 x 20 cm spacing (79.33 cm) closely followed by 15 x 10 cm spacing (77.17 cm). Highest dry matter (20.20g) had been found in 2<sup>nd</sup> December with 15 x 10 cm spacing due to its more vigorous growth. These parameters were also affected by micro meteorological parameters like canopy temperature, relative humidity within middle tier of crop canopy and relative humidity of lower tier of crop canopy. As the crop canopy temperature was the expression of soil and plant water status, higher canopy temperature was due to lesser soil moisture and plant water status. Canopy temperature was highest in case of 25<sup>th</sup> November sowing with 15 x 10 cm spacing (34.753<sup>0</sup>C) followed by 18<sup>th</sup> November sowing with 20 x 20 cm spacing (31.59<sup>0</sup>C). Higher values of relative humidity in 15 x 10 cm spacing

(58%) was due to the fact that dense canopy acted as barrier to water vapour movement owing to lesser turbulence and hence, the crop with close spacing exhibited higher relative humidity.

Regarding yield parameters the seed sown in 4<sup>th</sup> November with 20 x 20 cm spacing produced highest seed yield (12.5 q/ha); because it produced maximum number of pod/plant (63.08) and the crop sown in 2<sup>nd</sup> December with 20 x 20 cm spacing produced lowest seed yield (5.5 q/ha).

**Abstract: 11166**

### **PREDICTION OF BLACK ROT DISEASE PROGRESSION OF CABBAGE BASED ON WEATHER PARAMETERS**

**\*S. Dutta, G, Thapa, A. Roy Barman and S. Hembram**

Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, \* AICRP on Vegetable Crops, Directorate of Research, BCKV, Kalyani, Nadia-741235, West Bengal, India, Email: [subrata\\_mithu@yahoo.co.in](mailto:subrata_mithu@yahoo.co.in)

A study on prediction of black rot in cabbage on the basis of agro-meteorological parameters was undertaken at the C block Research farm, B.C.K.V., Kalyani during June to September 2009. The weather parameters maximum, minimum and mean air temperature, maximum, minimum and mean relative humidity and rainfall were taken into consideration for correlation study with rate of disease increment. The rate of disease increment was found to be positive with maximum and minimum RH, rainfall and negative with maximum, minimum and mean air temperature. Among weather variables the correlation coefficient of rainfall and maximum RH with rate of disease increment was found to be significant at 1% and 0.5% levels, respectively. Average temperature 27-30°C and average RH more than 85% and rainfall found to be mainly associated with the disease.

In order to predict the rate of disease increment with weather variables a linear multiple regression model was developed using different weather variables through step wise technique. Using step wise regression technique combination of some weather variables (rainfall and minimum temperature) were selected, which jointly found to account for 98.4% of rate of disease increment and can be used as predictor of rate of disease increment on the basis of measured weather variables. Thus from the above finding it may be concluded that rainfall and minimum temperature are two most important weather variables significantly contributed towards the rate of increment of black rot disease.

**Abstract: 11091**

**IMPACT OF CLIMATE CHANGE ON AGRICULTURE AND  
FOOD SECURITY IN BANGLADESH**

**Ahmed, H. P.<sup>1,2</sup> and Parven, A.<sup>2</sup>**

<sup>1</sup>Program Officer, Food security Programme-2006, Soil Fertility Component Project, Soil Resource Development Institute (SRDI), Ministry of Agriculture, Bangladesh. <sup>2</sup>Lecturer, Department of Agribusiness, Atish Dipankar University of Science & Technology, Dhaka, Bangladesh. E-mail: hasan.pervej@gmail.com.

Climate change impacts on right o food raises questions in Bangladesh about capacity to adaptation to attain food security because of the uneven distribution/allocation of resources and crop damages due to recurrent climatic events of floods, salinity and drought. The women and children among the poor and marginal peoples are the major victims who are trying to adapt spontaneously to such impacts but limited resources and vulnerability to natural disasters hindering them to solve their food security. In Bangladesh in particular the poor and marginal people, are expected to suffer most especially by flood and salinity.

The justice and equity implications of climate change need to be focused so they can be addressed when adaptation strategies are developed at the national level. This task is becoming more urgent with the increasing attention given to adaptation under the United Nations Framework Convention on Climate Change (UNFCCC) and the recent creation of new funding mechanisms to assist adaptation. Data used in this paper were collected using a variety of methods. Some of these methods were formal and structured while others were informal, or exploratory. The major data collection tools used were however Focus Group Discussion (FGD) through PVA of different groups, key informant interviews with different individuals and key informant surveys.

**Abstract: 11174**

**VARIETAL SCREENING AND EPIDEMIOLOGY OF MANGO BACTERIAL CANKER  
DISEASE (MBCD) UNDER WEST BENGAL CONDITION**

**<sup>1</sup>S.K. Ray, <sup>2</sup>S.Dutta, <sup>3</sup>N.Hossain and <sup>4</sup>S.Jha**

<sup>1,2,3</sup> Department of Plant Pathology, <sup>4</sup>Department of Entomology, BCKV, Mohanpur, Nadia, West Bengal, India-741252. Email: sujitkray2005@yahoo.com

The mango is a very important cultural and religious symbol in India. India is the largest producer of mango in the world accounting for 52.63% of the total mango production and 22.06% of total area under fruits but it ranks sixth in terms of productivity. The poor productivity

of mango is associated with several factors and among these, different diseases affect the mango crop at all stages of its development, from plants in nursery to the fruits in transit and storage are the important limiting factor in mango cultivation in some regions. Among the diseases causing major losses to the crop mango bacterial canker disease (MBCD) is one of the most serious malady that badly threatened in many mango growing regions of West Bengal in recent years. Keeping this background the present experiments were conducted during 2007 & 2008 at Central Research Farm, Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, Nadia, West Bengal with the view to gather more information regarding MBCD under West Bengal condition.

Disease severity of MBCD on 10 mango varieties have been recorded in fruiting season during 2007 & 2008 at weekly interval and it was revealed that Variety Swarna Jehangir (34.40% and 28%) showed maximum disease severity and considered as most susceptible cultivar towards MBCD followed by Ratna (25% & 27.0% ), Bombai (20.52% & 13.89%) and Himsagar (20.14%& 12.55%)in both the years (2007& 2008). The minimum severity have been found in cultivar Amrapali (1.05%& 3.87% ) followed by Langra (7.14% & 2.92%), Gulabkhas (5.19% & 5.19%), Sorikhas (2.92% & 3.61%) and showed moderately resistant reaction towards the MBCD under West Bengal condition.

Experimental results also revealed that Pre -monsoon rainfall was found to be the most important pre-disposing factor for onset of MBCD and the disease development was favoured by average Relative Humidity (RH) of 75% – 80%, difference of maximum and minimum RH of 20% – 25% and maximum and minimum temperature range of 30° – 35°C and 20° – 25°C respectively.

**Abstract: 11102**

### **EFFECT OF COMPOSTED SEWAGE SLUDGE AND COW DUNG ON BORO RICE IN POT EXPERIMENT**

**M. S. Hossain<sup>1</sup>, K. M. Khalequzzaman<sup>2</sup>, M. A. Sattar<sup>3</sup> and M. W. Zaman<sup>4</sup>**

<sup>1</sup>Deputy Director (Retd.), Department of Agriculture Extension, Sirajganj, Bangladesh

<sup>2</sup>Senior Scientific Officer, Regional Agricultural Research Station, BARI, Ishurdi, Pabna, Bangladesh, <sup>3</sup>Chief Scientific Officer and Head, Soil Science Division, BINA, Mymensingh, Bangladesh and <sup>4</sup>Professor, Department of Agricultural Chemistry, BAU, Mymensingh, Bangladesh

Pot experiments was conducted during 2003 at the net-house of the Department of Agricultural Chemistry, BAU, Mymensingh, Bangladesh to ascertain the effects of composted sewage sludge (SS) and cowdung (CD) on rice. Two levels sewage sludge and cowdung (5 and 10 t ha<sup>-1</sup>) individually or in combination with two levels of chemical fertilizers (CF=NPKSZn) @ 50 and

75% of the recommended dose were applied. One control and one 100% CF were also included. CRD experimental design in pot experiments were followed with four replications. Sewage sludge @ 10 t ha<sup>-1</sup> in combined with 75% CF performed the highest grain (57.18 g), the highest effective tillers hill<sup>-1</sup> (38.33) and TDM (total dry matter, 124.4 g) production and SS 5 t ha<sup>-1</sup> with 75% CF produced the maximum straw (69.0 g) and also influenced the tallest plant (113.3 cm) during the year 2003. Rice yield and yield attributes significantly increased with the increasing amount of composted SS in combination with 50 or 75% recommended rate of CF. Among the different combined treatments, SS combinations imparted better role on yield and yield attributes than CD combinations. The overall findings suggest that the composted SS combined with 50 or 75% CF can be an efficient practice for ensuring higher rice yield without deteriorating soil fertility.

**Abstract: 11100**

### **MANAGEMENT OF ANTHRACNOSE DISEASE OF COUNTRY BEAN FOR SAFE FRESH FOOD PRODUCTION**

**K. M. Khalequzzaman**

Senior Scientific Officer, Regional Agricultural Research Station, BARI, Ishurdi, Pabna, Bangladesh, Email: zaman.path@gmail.com

The experiment was conducted with two sets at Agricultural Research Station, BARI, Pabna during 2008-09 to find out the effective control measure for anthracnose disease of country bean for producing safe fresh food without harmful chemicals. The experiment was carried out following RCB design with three replications for both experiments. For experiment set 1 (fungal inoculum was sprayed before treatments apply), the highest amount of (27.67%) leaf area diseased was recorded in control plots while the lowest (11.67%) was in Tilt 250 EC. Percent infected fruits varied from 12.23 - 25.56%, while the highest was observed in control and the lowest was in Tilt 250 EC. Significantly higher (3.20%) fruit area diseased was obtained from control and the lowest (1.33%) was obtained from Tilt 250 EC. Yield ranged from 4.00 - 9.17 t/ha, where the highest and lowest was recorded in control and Tilt 250 EC, respectively. For experiment set 2 (fungal inoculum was sprayed after treatments apply), the highest (45.00%) leaf area diseased was recorded in control plots while the lowest (30.00%) was in Tilt 250 EC. Percent infected fruits varied from 29.70 - 57.18%, while the highest was observed in control and the lowest was in Tilt 250 EC. Significantly highest (6.95%) fruit area diseased was obtained from control and the lowest (2.67%) was obtained from Tilt 250 EC. Yield ranged from 3.50 - 6.13 t/ha, where the highest and lowest was recorded in control and Tilt 250 EC, respectively. It may be concluded that Tilt 250 EC was the best fungicide but Bordeaux mixture and Baking powder also showed better performances.

**Abstract: 11130**

**PHENOLOGICAL DEVELOPMENT, GROWTH AND YIELD OF LENTIL  
GENOTYPES UNDER PREVAILING TEMPERATURE AT VARYING SOWING TIME**

**M. A. K. Mian<sup>1</sup> and M. R. Islam<sup>2</sup>**

<sup>1</sup>Senior Scientific Officer and <sup>2</sup>Scientific Officer, Regional Agricultural Research Station  
Bangladesh Agricultural Research Institute, Ishurdi, Pabna  
Email: mianmd.abulkhayer@yahoo.com

The experiment was conducted at the Regional Agricultural Research Station of Bangladesh Agricultural Research Institute, Ishurdi, Pabna in High Ganges River Flood Plain Soil of AEZ 11 during the growing period of October 2009 to March 2010. The treatments were five sowing time (26 October, 5 November, 15 November, 25 November and 5 December of 2009) and seven genotypes of lentil (BARI Mosur 3, BARI Mosur 4, BARI Mosur 5, BARI Mosur 6, BLX-98001-1, BLX-98002-3 and X-955-167(4)). The crop was grown following the production package recommended by BARI (2004). The soil of the experimental plot was clay loam with pH value of 7.46. The crop received no rainfall during the whole growing period. Summation of day degrees ( $^{\circ}\text{C}$ ) was computed after Yoshida (1981) and attempt was made to establish relationship of phenological development and day degrees with the yield of lentil. Genotypes required 115-120, 107-115, 102-108, 97-100 and 91-93 days for maturity at the sowing time of 26 October, 5 November, 15 November, 25 November and 5 December respectively. Growing day degrees required 2271-2372 $^{\circ}\text{C}$ , 2053-2227 $^{\circ}\text{C}$ , 1898-2043  $^{\circ}\text{C}$ , 1808-1862  $^{\circ}\text{C}$  and 1688-1743  $^{\circ}\text{C}$  for the genotypes on respective sowing time. Crop growth rate was higher (3.23-3.71 g/m<sup>2</sup>/day) in 25 November among the sowing times irrespective of genotypes. BARI mosur 3 and BLX-98001-1 produced the highest yield (2093–2463 kg/ha) at 26 October sowing. But BARI mosur 3, BARI mosur 4, BARI mosur 5 and X-955-167(4) gave the seed yield of 2185-2685kg/ha at 5 November sowing. All the genotypes produced seed yield of 2185-3093kg/ha at 15 November sowing. However, all the genotypes produced the highest seed yield of 2185-3148 kg/ha at 25 November sowing while those genotypes yielded 2019-2676 kg/ha at 5 December sowing. Estimated optimum day degree was 1849  $^{\circ}\text{C}$  for lentil yield and the effect of temperature can be explained 51% by the function of  $Y=-16413+20.17x-0.0056x^2$  ( $R^2= 0.51$ ). The effect of duration for reproductive development on the yield can be explained 40% by the function of  $Y=-1506.2+186.1x-2.108x^2$  ( $R^2=0.40$ ). Again, the effect of temperature during reproductive development on the yield can be explained 37% by the function of  $Y=-7022.1+22.82x-0.0136x^2$  ( $R^2=0.37$ ).

**Abstract: 11126**

**CLIMATE CHANGE AND AGRICULTURE- A STUDY IN INDIAN PERSPECTIVE**

**Alok Chantia<sup>1</sup> and Preeti Misra<sup>2</sup>**

<sup>1</sup>Lecturer, Dept. of Anthropology, Sri Jai Narain Post Graduate College, Lucknow, UP, India, Email:alokchantia@gmail.com, <sup>2</sup>Lecturer, Dept.of Human Rights,School for Legal Studies,Babasaheb Bhimrao Ambedkar University,Lucknow, UP, India Email: misra9us@gmail.com

Climate Change very frequently discussed issue can be caused by internal and external forces like the earth's orbit, solar radiation and green house gas concentrations. The normal causes of climate change are of far less significance as compared to the interference of humanity with the nature. Warm winters and irregular monsoons are just a few visible instances of climate change. The indicators of climate are –rainfall, sunshine, relative humidity, wind and temperature.

Population of any country may have its survival by the availability of food which is nothing but reflection of agriculture. Land has its limit in any country, hence productivity of land is enhanced by the use of fertilizers etc. Besides fertilizer other factors such as weather and rainfall is also important for production of food grains etc. Due to process of urbanization excessive use of fuel, emission of carbon di oxide, green house effect have disturbed climate and adversely affected fertility of the land causing loss to agriculture. The best example of adverse effect of climate change is increasing rate of suicide of farmers in southern states. Due to adverse climatic conditions land has become infertile or having low productivity causing economic loss to farmers. They are not able to repay the debt taken on the belief that production will be high due to draught like situation prevailing in their districts. Disturbance in scheduled rain has left farmers with no other choice to fetch ground water for irrigation. The whole process creates a vicious cycle for global warming and glacier melting.

Globalization is not the only factor responsible for poverty but climatic change like uncertain weather and production causing economic problem also divides the society into rich and poor. Even today India is an agriculture based country where approximately 80% of the population is engaged in agriculture with traditional methods. India is also second largest populated country of the world having 1/6<sup>th</sup> of geographical area. India is the best place where we can analyse coping management between large population and available agricultural land. In the proposed paper we aim to analyse effect of climatic change on agriculture. Why climatic changes cause suicides amongst farmers in India? Whether hunger, starvation and poverty are associated with climate change in India? How displacement is increasing due to climate change? Whether humanity and humans will disappear from this earth due to climatic change? Whether laws in India are sufficient to secure right to life by securing safe environment. All these questions will be answered in our proposed paper.

**Abstract: 11171**

**THE EFFECTS OF GLOBAL CLIMATE CHANGE ON VEGETABLE CROP GROWTH,  
YIELD AND QUALITY**

**Ranjit Chatterjee**

Department of Vegetable and Spice Crops, Uttar Banga Krishi Viswavidyalaya, Pundibari,  
Cooch Behar-736165, West Bengal, India, Email: ranchat22@rediffmail.com

Vegetable crops are short duration plant and different development phases namely vegetative growth, flowering, economic part development are significantly influenced by climatic vagaries. Crop growth is a complex process. The unfavorable effects of the increasing temperature and decreasing precipitation may adversely affect the crop productivity. It is therefore necessary to understand the crop vulnerability under climate variability and change. Climate change can modify the crop physiological processes and hampered the normal flowering, pollination and fruit development and that may result decreased biomass accumulation and severe yield loss. Scenarios of global climate change forecast an increase in air temperature of 4.0 degrees C over the next 100 years. This would lead to thermal expansion of sea water, along with partial melting of land-based glaciers and sea-ice, resulting in a rise of sea level, more frequent hot extremes and droughts which in turn would result in greater instability in food production. Concerning the possible impact of climatic change on crop yields as well as the economic consequences research initiatives like selection of better adaptable genotypes, genetic manipulation to exploit the beneficial effects of CO<sub>2</sub> enhancement, approaches to increase N-use efficiency and biological nitrogen fixation have been taken to mitigate the challenges This study reviews the impact of climate change on physiological process and yield potential of different vegetable crops and strategies to overcome the harmful consequences. It also reviews the effects of climate on quality aspects of different vegetable crops that may occur under changed climate.

**Abstract: 11175**

**IMPACT OF CLIMATE CHANGE IN INDIAN HORTICULTURE**

**S. Datta**

Department of Vegetable and Spice Crop, Uttar Banga Krishi Viswavidyalaya,  
P.O.-Pundibari, Cooch Behar - 736165, West Bengal, India  
Email: suchanddatta@rediffmail.com

Global warming and climate change is the greatest concern of mankind in 21<sup>st</sup> century. The consequences of such rapid change are - global warming, change of seasonal pattern, excessive rain, melting of ice cap, flood, rising sea level, drought, etc. leading to extremity of all kinds.

Decrease in potential yields is likely to be caused by shortening of the growing period, decrease in water availability and poor vernalization. The established commercial varieties of fruits, vegetables and flowers will perform poorly in an unpredictable manner due to aberration of climate. Melting of ice cap in the Himalayan regions will reduce chilling required for the flowering of many of the horticultural crops like Apple, Saffron, Rhododendron, Orchid, Tulipa, Alstromeria, Narcissus etc. Western Ghats and surrounding regions may be deprived of normal precipitation due to abnormal monsoon. Vulnerability, rarity and rapid extinction of plant species will be among the other consequences. Plains of India will be face similar kind of problems. Commercial production of horticultural plants particularly grown under open field conditions will be severely affected. Due to high temperature physiological disorder of horticultural crops will be more pronounced eg. Spongy tissue of mango, fruit cracking of litchi, green beak disease in tomato flower and fruit abscission in solanaceous fruit vegetables, etc. Air pollution also significantly decreased the yield of several horticultural crops and increase the intensity of certain physiological disorder like black tip of mango which induced by coal fume gases, sulphur dioxide, ethylene, carbon mono oxide and fluoride. Hence there is a need to protect these valuable crops for sustainability against the climate change scenario. The most effective way is to adopt conservation agriculture, using renewable energy, forest and water conservation, reforestation etc. to sustain the productivity modification of present horticultural practices and greater use of green house technology are some of the solutions to minimize the effect of climate change. Development of new cultivars of horticultural crops tolerant to high temperature, resistant to pests and diseases, short duration and producing good yield under stress conditions, as well as adoption of hi –tech horticulture and judicious management of land use resources will be the main strategies to meet this challenge.

**Abstract: 11233**

## **COMBATING CLIMATE CHANGE IMPACTS IN ORGANIC HORTICULTURE-THE INDIAN CONTEXT**

**M. K. Pandit**

Department of Vegetable Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya,  
Mohanpur-741252, Nadia, West Bengal, India.  
E-mail: mkumarpandit@yahoo.com

Indian agriculture has always been at the mercy of the prevailing weather. About 70 % of the Indian population directly or indirectly derive livelihood from agriculture. Presently it is well accepted that climate change is a happening reality and by all means, inevitable. Indian farmers like many other developing and emerging economies need to cope up with the change.

Climate change vis-à-vis global warming is a natural phenomenon that took place in the past, causing many farming complexities, even extinction of species and civilizations. But the changing climate during the post industrial-revolution era is ominous and sure to jeopardize both the livelihood and food security of a huge multitude; for last two hundred years the emission of GHG, especially CO<sub>2</sub> has increased alarmingly in the atmosphere, mainly due to anthropogenic reasons. Scientists predict that by 2100 AD, atmospheric temperature may rise by 1-6<sup>0</sup> C, not evenly in all agro-ecological zones across the globe and thus causing erratic monsoon, droughts, heat waves, fierce storms, glacial run-off, sea level rise and subsequent inundation of coastal lands, shifting of climatic and agricultural zones away from the tropical latitudes etc.

So, in any way or the other, crop production in India will be strongly affected, particularly with erratic rainfall pattern. With increasing temperature regime, the Himalayan glaciers (the major source of potable fresh water) are melting at a faster rate causing 75% increased water current in north Indian rivers in last 30 years (Nambi,2006). As a result there will be frequent flood in north Indian plains and in *Brahmaputra* valley of Assam posing great threat to major staple food production systems and the tea industry.

For mitigating the climate change impact, organic way of crop production may be a viable option, which brings with it a load of other environmental benefits. In an emerging economy like India, most of the agricultural practices are dependent on intensive use of external inputs and chemicals, though a large tract of her remote, hilly and other difficult terrains are still by-default pursuing traditional and organic way of sustainable crop culture. Indian farmers had been practicing ecological agriculture for centuries not exploiting the natural resources at the cost of environment. It is only on the advent of the Green Revolution, the danger to ecology and environment was noticed. In conventional agriculture, the chief components of energy consumption are the mineral nitrogen fertilizer and the burning of fossil fuel to run machineries. Nitrogen nutrition through symbiotic fixation by legumes is a potential means of reducing CO<sub>2</sub> emissions in organic farming. In India labour is cheap and devising suitable crop production systems, can create ample employment opportunities by replacing machinery with human labour; thus reducing distress migration from rural India. Organic crop culture would require less than a half of the fossil energy required in conventional production systems (Haas *et al.*, 1995). It can enrich both the 'plant – soil carbon sink'. But the question of feeding the Indian population, only by means of organic system of food production remains a high debate and often unanswered due mainly to lack of concrete data derived from reliable and representative production system and market information.

**Abstract: 11119**

**SPATIAL ANALYSIS OF RAINFALL DISTRIBUTION AND ITS IMPACT ON AGRICULTURAL DROUGHT AT BARIND REGION, BANGLADESH**

**A.T.M. Jahangir Alam<sup>1</sup>, A.H.M. Saadat<sup>1</sup> and M Sayedur Rahman<sup>2</sup>**

<sup>1</sup>Department of Environmental Sciences, Jahangirnagar University, <sup>2</sup>Faculty of Business Administration, Eastern University. Email: kallal1022@gmail.com

Spatial analysis of rainfall was carried out in the Barind region of Bangladesh to find out its impact on regional agricultural drought. Markov Chain model was used to evaluate the severity of drought from the rainfall data recorded in 12 rainfall gauge stations for the period of 1971-2008. Different statistical approaches (i.e. series mean, mean of nearby points, linear interpolation, linear trend at point and normal ratio method) were used to investigate the missing rainfall data series. A well known GIS software (ArcGIS) was used to map the spatial extent of agricultural drought of different severities in different agricultural seasons. Critical analysis of wet and dry spells and goodness of fit test using chi-square test were also carried out to aid prediction of future drought in the study area. The maximum variation of rainfall probability was found during Pre-kharif (March –May) and Kharif (June to October) period. However, no variation was found during Rabi (November – February) period. During Pre-kharif periods in 10 years time scale mild to severe drought were found but in one year time scale occasional to chronic drought was found. During kharif period in 10 year time scale mild drought was found only for one time in Bholahat station but rest of the time occasional drought was found. But in one year time scale chronic to occasional drought was found. It was observed that the unchanged average rainfall over long period of time also contributed to the agricultural droughts of some regions. These drought maps could be useful to monitor the agricultural drought on the basis of spatial distribution of average rainfall. This can also be useful to make a prediction of drought prone areas.

**Abstract: 11214**

**FUTURE IMPACT OF STORM SURGE DISASTER ON AGRICULTURAL PRODUCTION IN THE POLDER UNDER CLIMATE CHANGE CONTEXT**

**P. K. Halder and M. R. Rahman**

Water Resources Development (WRD),  
Institute of Water and Flood Management (IWFM), BUET, Dhaka,  
E-mail : pronab.halder@gmail.com, rezaur@iwfm.buet.ac.bd

About 145 numbers of polders having more than 5000 km of embankment were constructed in mid sixties to protect the coastal low-lying areas from saline water inundation in order to increase agriculture production without consideration of safety against cyclonic surges. Prime goal of the polders shifted from agriculture to shrimp culture. Day by day polders become vulnerable to disasters like cyclonic storm surge, coastal flooding, drainage congestion, salinity intrusion with changing climate. Polder no-5 has been studied for this paper. Last year cyclone 'Aila' destroyed 43% of rice and 36% of fisheries production through storm surge flooding. The intensity and magnitude of natural disasters usually increasing due to climate change. This study estimate future surge height with respect to 'Aila' surge level (*e.g.* base year study) and calculate the escalating inundation area especially for 2030, 2050 and 2100. This examination has been conducted by DEM analysis of polder no-5 through GIS. From 2009 to 2100, the storm surge flooding area will be increased from 2519 (22%) to 47202 (86%) hectars. Then tools of PRA especially seasonal and resource mapping has been applied for anticipate future mode of agriculture of the inhabitants. Through literature review and past data analyses indicate an approximate production trend of the agricultural sectors in future of this polder. However, the loss will enhance from 43% to 100% of rice production and 36% to 95% of fish production in 2100. This paper reveals not only climate change influenced surge height but also subsequent agricultural devastation. A cause effect linkage has been developed to understand future mode of agriculture in the polders.

**Abstract: 11189**

**EFFECTS OF AMINES PRETREATED ON GRAFT COPOLYMERIZATION OF ACRYLIC ACID AND METHACRYLIC ACID ONTO BIODEGRADABLE JUTE FIBER**

**M.A. Latif<sup>1</sup>, Md. Ibrahim H. Mondal<sup>2</sup>, M. G. Mostafa<sup>1</sup> and Md. Khademul Islam<sup>2</sup>**

<sup>1</sup> Institute of Environmental Science, University of Rajshahi, Bangladesh, <sup>2</sup>Polymer and Textile Research Lab, Department of Applied Chemistry & Chemical Engineering, University of Rajshahi, Bangladesh. E-mail: mihmondal@yahoo.com

In recent years, consciousness about environmental preservation, control of pollution and help to the sustainable development the demand of natural fibre increasing day by day. At present jute fibre use not only in their traditional application areas but also in many new and diverse applications like coated jute textile, jute reinforced plastic etc. To improve the quality products and exploitation of jute in these application areas, modification of bleached jute fibre was considered by graft copolymerization of acrylic acid and methacrylic acid onto amine pre-activated jute fiber. Amine activated bleached fibres were polymerized by using acrylic and

methacrylic acid with the help of potassium persulfate as an initiator and ferrous sulfate as catalyst. The effects of parameter variables, such as the monomer, initiator, and catalyst concentrations, the reaction time, and the temperature, on grafting and the effect of grafting the monomers onto jute constituents were studied. The graft yield increased with the increase of monomer concentration, initiator concentration, catalyst concentration, time and temperature up to certain value and thereafter decreased. In case of acrylic acid, the optimal monomer concentration, initiator concentration, catalyst concentration, time and temperature were 90%, 1.2%, 1% (on weight of fibre), 90min, 80°C and for methacrylic acid were 100%, 2%, 1% (on weight of fibre) 90 min, 60°C respectively. The maximum graft yield of without amine treated bleached, butyl amine activated and dibutyl amine activated at optimum conditions were 21%, 23%, 26% for acrylic acid and 14%, 16%, 18% for methacrylic acid. These results suggest that the polymerization of amine treated jute fiber with acrylic acid and methacrylic acid increased the grafting rate. This results also suggest that activation of jute with amine has great impact on grafting. The thermal stability of amine activated modified jute fibre increased which is confirmed by TGA, DTA, & DTG.

**Abstract: 11110**

## **TOMATO LEAF CURL DISEASE SEVERITY UNDER CHANGING CLIMATIC SCENARIO**

**G. Saha<sup>1\*</sup>, D. Das<sup>1</sup>, M. K. Nanda<sup>1</sup> A. Pal<sup>2</sup>, S. Gonsalves<sup>2</sup> and S. Karmakar<sup>3</sup>**

<sup>1</sup>Department of Agricultural Meteorology and Physics, <sup>2</sup>Department of Floriculture  
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, West Bengal.

<sup>3</sup>Department of Geology, NIT, Durgapur, West Bengal-713209

**\*Email: gsagmet@yahoo.co.in**

Tomato is highly sensitive to pest and disease attack. The onset and spread of disease caused by fungus or bacteria or virus, greatly depend on the weather parameters during the growing period of crop. So by altering the sowing date, an approach to avoid the disease onset, as well may be made operational which will be beneficial for higher production of the crop. High temperature adversely affect fruit-set and accompanied by high humidity favours development of several diseases. Use of mulch and manipulating transplanting dates could produce appropriate agroclimatic environment and lesser disease incidence which would help to produce maximum fruit per unit area. In view of this, field experiment was conducted in Bidhan Chandra Krishi Viswavidyalaya (22°56 N latitude, 88°32 E longitude and altitude of 9.75 m above mean sea level), Mohanpur, Nadia, West Bengal, during the winter season November 2007 to April 2008,

to evaluate the influence of different mulching treatments, viz. rice straw mulch, black plastic mulch and control (farmers' practice) and two dates of transplanting, viz. 23 November and 7 December on leaf curl disease severity of tomato. Results revealed that incidence of leaf curl virus disease were affected significantly due to variation in mulching materials used and transplanting dates followed. Crops grown under straw mulch treatment showed higher values of humidity than those grown with plastic mulch. So, crops grown under straw and black plastic mulching had lesser leaf curl disease severity than those grown under no mulch treatment. Relationships between Growing degree days (GDD) and leaf curl severity % revealed that GDD accounted for 33 to 65 % variation in total disease severity %. Thus, it seems worthwhile that GDD is a better index to predict leaf curl disease. Larger yield in crops using black plastic mulch were associated with higher GDD and lesser leaf curl disease severity. So by adjusting dates of planting and using various mulch to develop special microclimatic environment within the crop may decrease the severity of leaf curl disease of tomato under changing and alarming climatic scenario.

**Abstract: 11142**

**SUSTAINABLE NUTRIENT MANAGEMENT IN RICE – *LATHYRUS (PAIRA)* – GREENGRAM SEQUENCE TO IMPROVE TOTAL PRODUCTIVITY OF LAND UNDER CHANGED CLIMATIC CONDITION OF COASTAL AREAS OF WEST BENGAL**

**Koushik Brahmachari<sup>1</sup>, Suborna Roy Choudhury<sup>1</sup>, Sruti Karmakar<sup>2</sup>,  
Shoubhik Dutta<sup>1</sup> and Pooja Ghosh<sup>3</sup>**

Dept of Agronomy<sup>1</sup>, Dept of Agril. Chemistry & Soil Science<sup>3</sup>, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, WB 741252, India. National Institute of Technology<sup>2</sup>, Dept. of Geology, Durgapur, Burdwan, WB 731209, India  
E-mail: shoubhikdutta\_ag@rediffmail.com

Climate change is now recognized as one of the most serious environmental, societal & economic challenges that the world is facing today. As the climate changes, one of the biggest concern is the effect of it on agriculture – yet there has been relatively little research investigating the fundamental question how humanity will feed itself in a changed climate. What are the implications for feeding the world's burgeoning population, especially the millions of poor who rely on small scale and subsistence farming? Rice is cultivated in more than 113 countries and provide livelihood of nearly 250 million people. It provides 20% of the dietary protein intake in the developing world. India is the second largest producer of rice in the world after China and is a staple food of 65% of the Indian population. Climate change threatens to

affect rice production across the globe. To feed the huge population of India it is important to increase the yield per unit area per unit time through judicious application of agro techniques for combating the ill effects of climate change agronomically, *i.e* proper resource utilization. In the coastal zone of west Bengal, climatic condition favours intensive cropping, though farmers of this zone are habituated to follow the traditional rice based system without thinking of their cost effectiveness and environmental sustainability. Keeping this view with a broader objective of utilizing locally available low cost different organic resources for substituting the chemical fertilizer partly and increasing cropping intensity of these zone in an eco friendly manner by including one legume in residual condition and another low water and nutrient requiring legume in the rice based crop sequence, a field experiment was undertaken at Regional Research Station (coastal saline zone) of Bidhan Chandra krishi Viswavidyalaya during 2007-08 and 2008-09 under coastal saline soil (pH 7.6, EC 4.1dsm-1, organic carbon 0.53%, total N 1140 kg ha-1 available K 486.21 kg ha-1, available P 15.20 kg ha-1) of Kakdwip (Latitude 21° 9' N, longitude 88° 10' E and altitude 5.5 m) West Bengal. The experiment was laid in Randomized Block Design (RBD) with 9 different nutritional management treatments each replicated 4 times, to evaluate the growth, productivity and economics in rice-*lathyrus(paira)* –greengram sequence. The growth parameters, yield components, and seed yield of all the crops in sequence were the maximum when organic manure was applied along with inorganic fertilizer at 75% of the Recommended Dose (RD). The effect of well decomposed fish meal (WDFM) was as good as farm yard manure (FYM) and vermicompost. The maximum rice equivalent yield, net returns and net production value in rice-*lathyrus(paira)* –greengram sequence were obtained from the crops treated with 75 % RD of NPK + 2 ton WDFM ha-1 only to rice.

**Abstract: 11143**

**STUDIES ON FLOWER PRODUCTION COMPONENTS OF TUBEROSE AS INFLUENCED BY CHANGING THERMAL ENVIRONMENT IN GANGETIC PLAINS OF WEST BENGAL**

**S. Gonsalves<sup>1</sup>, A. K. Pal<sup>1</sup>, B. Tamang<sup>1</sup> and G. Saha<sup>2</sup>**

<sup>1</sup>Department of Floriculture and Landscaping, <sup>2</sup>Department of Agricultural Meteorology and Physics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, West Bengal

Email: sreela\_hort@rediffmail.com

One of the important geophytes cultivated in Gangetic plains of West Bengal for loose flower, cut flower and even for essential oil used in perfume industry is tuberose (*Polianthes tuberosa*). The variety Calcutta Single is extensively cultivated here and have great importance, in all

aspects stated above. Since this crop is cultivated in open condition, of all weather parameters, rate of development and growth is predominantly determined by temperature. Moreover the vegetative growth of plant influences the quality and quantity of flowering spikes. With the above background in view a field experiment was conducted at Bidhan Chandra Krishi Viswavidyalaya, Mondouri, Nadia (23<sup>0</sup> N latitude, 89<sup>0</sup> E longitude and altitude of 9.75 m above mean sea level) West Bengal to evaluate the role of thermal regimes based on agrometeorological indices of temperature and sunshine hours on vegetative of production components of tuberose cv. Calcutta Single under three different dates of planting (17th February, 17th March, 17th April, 2009). Results revealed that the highest leaf number per clump (183.667), leaf length (51.6cm), leaf breadth (1.43cm) and plant height (59.11 cm) were obtained in plants planted during mid February, 2009. The highest leaf length and plant height were obtained in September, 2009, when accumulated monthly Growing Degree Days (GDD) was 732.8°C Days and average monthly sunshine hour was 6.29hrs. While maximum leaf number and leaf breadth were obtained in April and March, 2009 respectively. The leaf length and plant height of mid February planted plants were positively correlated with monthly accumulated GDD. The leaf number and plant height of plants planted on all three planting dates were found to be positively correlated with average monthly sunshine hours.

**Abstract:11157**

INFLUENCE OF WEATHER FACTORS ON PERFORMANCE OF  
IMPORTANT *KHARIF* LEGUMES IN THE GANGETIC ALLUVIAL REGION

**M. K. Nanda, A. K. Mukherjee, G. Saha, M. Nandy and S. Chowdhury**

Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India  
Email: mknandabckv@rediffmail.com

The crop adaptation to changing climatic scenario is perhaps the most critical issue for sustaining agricultural productivity. The seasonal utilization of radiative energy for photosynthesis as well as partitioning of photosynthates between source and sink of plant structure determine its potential productivity. Hence, the duration of vegetative phase and reproductive phases are

considered to be critical factors for building up an efficient source-sink relation of any crop. It is more so for most of the pulse crops which show non-synchronous in flowering and maturity behaviour. In the present experiment two varieties of rice bean (RBL-36 and PRR-9401) along with two other short duration kharif pulses namely, black gram and green gram were grown under different dates of sowing starting from mid February to mid September at one month interval, to study their phenological behaviour vis-à-vis yield in the Gangetic alluvial region of West Bengal in two consecutive years, 2004 and 2005.

The rice bean varieties RBL-36 and PRR-9401 recorded long duration (about 250-260 days) when sown in February. Delay in sowing till September resulted in steady decrease in total crop duration. It was also noticed that the variation in total duration was mainly due to extended vegetative phase in the earlier sown crops. On the other hand reproductive phase duration was more or less consistent in PRR-9401. However, in RBL-36, the reproductive duration showed a steady decrease with delay in sowing till September. In case of black gram and green gram there was no definite trend of phasic duration with variation in date of sowing. The highest crop duration in both the crops was recorded when the crops were sown in June and the lowest duration was recorded when sown in the month of May. The wide variation in vegetative phase of rice bean under varying sowing dates implied its photo and thermo-sensitivity towards light and thermal environment for onset of reproductive phase.

The grain yield of rice bean varieties was controlled by phasic duration. June sown crop recorded optimum vegetative duration for higher production in both the varieties. Nanda *et al.* (2000) also recorded decreased grain yield due to delay in sowing after 31<sup>st</sup> August. Bhattacharya *et al.* (1996) also observed that sowing after mid August resulted in drastic reduction in grain yield.

The highest grain yield of green gram was recorded when the crop was sown during February. Sowing after July recorded poor grain yield. The crop sown in February and March had completed their maturity phase before May which was more or less dry period with clear sunshine. This provided an ideal condition for growth and reproduction of green gram resulting in higher yield. But sowing after July led to reduction in crop yield. Saharia (1981) reported that yield and yield components of green gram were gradually reduced by delay sowing towards August. The trend of grain yield of black gram was similar to that of rice bean varieties. However, the photo-and thermo sensitivity behaviour was not clearly noticed unlike rice bean. The temperature humidity and bright sunshine hour during flowering and maturity phases were the key factors for the yield variation.

**Abstract: 11165**

**SUSTAINING CROP PRODUCTIVITY THROUGH BIOVILLAGE PROGRAMME  
UNDER RICE- POTATO BASED CROPPING SYSTEM IN WEST BENGAL**

**M. De. Roy, A. Hui and L. K. Jana**

Pulses & Oil Seed Research Station, Berhampore, West Bengal, India  
Email: mithuderoy@yahoo.in

Bio-village is a dynamic programme with a holistic approach that harmonizes the need of the present with the future generation. The aims of the programme are to promote the efficient and sustainable use of natural resources and to achieve a continuous and steady growth of agricultural production while protecting and improving the environmental capital stocks of the village under the changing climatic scenario. A biovillage programme was undertaken during 2007-2008 on potato in the area of 10 ha under Macro Mode Management Work Plan with reduction in NPK fertilizers which was supplemented by several bio inputs at Sinet village of Polaba-Dadpur block of Hooghly District, West Bengal, India, where rice-potato based cropping system is the predominating one. The objective was to use farmers' participatory research approach and select the most suitable organic and inorganic fertiliser combination(s) with lowest pest infestation, acceptable usable yields and also to demonstrate use of some components of integrated disease/pest management methods in reduction of disease/pest incidence and spread. Seven treatments with three replications at three different farmers plots having 16.5 decimal (571.4 square meter) of size along with three respective checks were selected. During November, 2007-2008 the programme was undertaken with potato variety Kufri Jyoti. The astonishing outcome of potato bio-village programme during 2007-2008 encouraged the farmers associated with the programmes for continuation of the reduction of use of NPK through supplementary bio-inputs during the following paddy and potato season of 2008-09. On *kharif* (June- July), 2009-2010, rice variety of MTU-7029 was planted following seven treatments in the similar manner at the same location. In both potato and rice higher yields were obtained in all the treatments as compared to the check. The highest yield was obtained at biofertilizers amended plots with 10 per cent reduction of NP fertilizers in potato and higher trend of productivity was still observed even at 20 per cent reduction of NP under biofertilizers amendment plots. The highest yield was obtained at biofertilizers and biopesticides amended plots with 100 kg of vermicompost / plot in rice and higher trend of productivity was still observed even at 30 per cent reduction of NP under biofertilizers amendment plots. The disease and pest incidence and severity was also found to be less under treated plots as compared to the checks. Considering the high cost of inorganic fertiliser and its negative effects on the

environment, reduced usage at 20 per cent rates in potato and 30 percent in rice combined with biofertilizers – biomanures is feasible option friendly to the farmer, soil and environment. The interviewed farmers also ranked the option as the most appropriate combination for obtaining for sustainable higher yield in rice- potato based production system under smallholding farming situation.

Abstract:11192

## **EFFECT OF ABIOTIC FACTORS ON THE OCCURRENCE OF PULSE APHID ON GREENGRAM IN THE LOWER GANGETIC PLAINS OF WEST BENGAL, INDIA**

**A. Banerjee and B. Bandyopadhyay\***

Howrah Krishi Vigyan Kendra, Bidhan Chandra Krishi Viswavidyalaya  
Indian Council of Agricultural Research, Jagatballavpur – 711408  
Howrah, West Bengal, India, Tele-fax: +913214 256577

\*AICRP on Tropical Fruits, Directorate of Research, B. C. K. V.,  
Kalyani – 741235, Nadia, West Bengal, India  
E-mail: amitava\_ecoento@rediffmail.com

Greengram [*Vigna radiata* (L.) Wilczek], an important member of the food legumes, is an excellent source of high quality protein (25%), which is consumed as whole grain as well as *dal* in a variety of ways in homes. A total of 64 species of insects was reported to attack greengram in the field condition. Amongst them, only a few are important as pest causing noticeable damage to the crop and pulse aphid (*Aphis craccivora* Koch) is one of them. The knowledge on the influence of weather parameters on the population build-up of certain pests of crops in a locality is a primary requisite for well-developed pest management system. Hence, the present investigation was undertaken to study the effect of abiotic factors on the occurrence of *A. craccivora* on different varieties of greengram.

The experiment was conducted at ‘C’ Block Farm, BCKV located at Kalyani, West Bengal, India with two different times of sowing in two seasons (both *prekharif* and *kharif*) in two consecutive years. Five varieties of greengram were sown for the experiment (Pusa Bold 2, Pusa Bold 1, T-44, K-851 and B-1) followed by suitable agronomic practices. Weekly observations of aphid population were recorded from 21 days after sowing till harvest from the sampled plants. Weekly observation of seven weather parameters namely maximum temperature, minimum temperature, maximum relative humidity, minimum relative humidity, rainfall, wind speed and

bright sunshine hour were also taken and these were used as predictor variables to predict the incidence of aphid on greengram following full model multiple regression analysis.

The combined effect of the weather parameters on population of aphid varied widely in magnitude from 33% to as much as 63% depending upon the variety of the crop. The estimated coefficient revealed a significant negative association with average wind speed of previous seven days at 5% level in all the cases. Other estimated coefficients were found insignificant, the aphid population exerted positive relationship (regression coefficient) with maximum temperature while negative relationship was obtained with minimum temperature. Maximum relative humidity had negative impacts on its population development. However, aphid population was positively correlated with minimum relative humidity and bright sunshine hour and negatively correlated with total rainfall of previous seven days except in one case where minimum relative humidity had negative impact on its population recorded on variety Pusa Bold 1. Significant negative effect of wind speed has also been recorded. The aphid incidence in relation of environmental factor as assessed by multiple regression model (equation) was proposed. This model revealed that the influence of independent variables for the variation of the dependent variable (aphid incidence) were 36%, 63%, 41%, 36% and 33% in case of variety Pusa Bold 2, Pusa Bold 1, T-44, K-851 and B-1, respectively.

Abstract:11218

## **EFFECT OF CLIMATE CHANGE ON VEGETABLE CULTIVATION IN NORTH EAST INDIA**

**P. Saha<sup>1</sup>, N.R. Das<sup>2</sup> and U. Mandal<sup>3</sup>**

<sup>1</sup>Division of Vegetable Science, <sup>2</sup> Division of Environmental Sciences, Indian Agricultural Research Institute (IARI), Pusa, New Delhi-110012, <sup>3</sup>Department of Agronomy, College of Agriculture, Lembucherra, Tripura (W)-799210  
E-mail- [horthparth@yahoo.com](mailto:horthparth@yahoo.com)

Today climate change is the most emerging threat on sustainable agriculture. The North Eastern region of India has remarkable advantages of fertile and organically rich soils, ample rainfall and water resources, river valleys, swamps and streams made possible to maintain diversity in vegetables species and facilitate vegetable cultivation. This region of India is expected to be highly prone to the consequences to climate change because of its geo-ecological fragility, strategic location vis-à-vis the eastern Himalayan landscape and international borders, its trans-

boundary river basins and its inherent socio-economic instabilities. Still now different traditional and nontraditional nutritionally rich vegetable are cultivated by the local and tribal people. Experiments are conducted at controlled environment to study the effect of climate change on vegetable crop physiology, yield and quality. Changes in normal climate leads to loss of valuable vegetable germplasms. High temperatures ( $>30^{\circ}\text{C}$ ) caused flower bud drop, abnormal flower development, poor pollen production, dehiscence, ovule abortion, reduced carbohydrate availability in vegetables like tomato, brinjal and beans. The seed production region of vegetables in higher altitude shifted toward more northern hemisphere. Excessive rainfall cause leaching of nutrients rendering soil's poor in base status and also have impacts on the fragile geomorphology of the Himalayan part of the Brahmaputra basin causing more widespread landslides and soil erosion. Flooding cause damage by reducing oxygen in the root zone which inhibits aerobic processes and tomato plants accumulate endogenous ethylene. Rainfall occurring earlier or later has adversely affected sowing and harvesting of vegetable, harvestable seeds also damaged. Drought and salinity leads to reduction in yield of colocasia, taro, kalmi, etc. The excess  $\text{CO}_2$  may have fertilization effect on some vegetables but due to increase in temperature may again lead to reduction in yield and quality. The way of mitigating adverse effect of climate change is germplasm conservation which is tolerant of high temperatures, flooding along with development of new varieties. Development of crop based simulation model like INFOCROP may help to manage adverse effect of climate change. Molecular marker analysis of stress tolerance in vegetables is limited but efforts are underway to identify QTLs. Precession farming, integrated pest and disease management, drip irrigation and use of soil amendments improve soil fertility and enhance nutrient uptake by plants. Through collaborative, complementary and coordinated effect along with capacity building and education are key components of a sustainable adaptation strategy to address the consequences of climate change on the vegetable cultivation in North East India.

Abstract:11088

## **FARMERS' OPINION ON IMPACT OF CLIMATE CHANGE ON COASTAL AGRICULTURE**

**S. K. Rout**

Dept. of Extension Education, College of Agriculture, Orissa University of Agriculture  
Technology, Bhubaneswar-751003, India, E-mail: santoshrou56@yahoo.co.in

Agriculture being the hub of economy of many countries is passing through tremendous pressure because of various factors. It has been experienced that among different factors the global warming related climate change is an important factor that affects the socio-economic development of the farming community. It is the prime factor that influences the farming activities in a particular region. Recent global climate change is such a stress which is projected to have a great impact on food production and hence requires special agriculture measures to combat with. Knowledge on extent of climate change and its potential impacts on agriculture in different regions are considered useful to formulate the required adoption measures for sustainable production and increase in productivity. A study was conducted in Puri district of Orissa, India, to ascertain the opinion of farmers' on "Impact of Climate Change on Coastal Agriculture", covering 200 experienced farmers. The information was collected with the help of structured interview scheduled and focus group discussion. The variables taken for the study were knowledge, experience and opinion. Majority of the farmers have opined that late monsoon onset with more pre-monsoon rainfall, less rainfall in February, June and October, extended summer up to June, increased number of hot, humid and summer days, heavy precipitation of rains, more number of low pressure in Bay of Bengal are the effect of climate change in coastal Orissa. They have also expressed that future climate change is likely to adversely affect agriculture, livelihood, food security and water resources. Further they have expressed their suggestions which can reduce the adverse effect of climate change. Such suggestions are crop diversification, resistant crop varieties, altered sowing time, integrated pest management, draught & flood management and land management.

**Abstract: 11051**

## **NATURAL REMOVAL OF ARSENIC FROM WATER IN AN EXPERIMENTAL POND**

**M. Fakhru Islam<sup>1</sup> and Shariar bin Rasul<sup>2</sup>**

<sup>1</sup>Dept. Appl. Chemistry & Chem. Technology, Rajshahi, University, Bangladesh

<sup>2</sup>Analytical Chemist, formerly at International Development Enterprises, Dhaka

E-mail: mfislam2000@yahoo.com

Arsenic contamination of tube well water is widespread in Bangladesh. People are becoming poisoned by the consumption of contaminated water by drinking and cooking especially in remote villages where bacteria free water is obtainable from tube wells only. Since the discovery of arsenic in tube wells the main purpose of supplying safe water to villages got a serious setback. All the other options such as rainwater harvesting, community based deep tube wells and household filters have their merits and demerits and may not suit all villages for various reasons.

This work reports the results of a preliminary experiment for an ordinary pond filled with arsenic contaminated tube well water in the Experimental Test plot of the International Development Enterprises at Shampur, Hemayetpur, in Savar District near Dhaka City.

The results of the experiment done repeatedly show that the arsenic level of arsenic containing water decreases fairly rapidly in approximately 15 days time from ~ 300 ppb to ~ 50 ppb . The experiment could not be continued for more days in view of the rapid fall of water level in the pond in the dry season months. In view of the observation that iron content of the pond water decreases to zero level during the 2-3 weeks time, it was thought worthwhile to find the minimum time for sedimentation of iron and the corresponding decrease of arsenic from pond water. The results show that the pond water iron level becomes zero in 24 hours time at the depth at which the sampling was made and the arsenic concentration is decreases by 150 ppb. A control experiment was made in which exactly 1litre of the raw tube well water was allowed to stand in a beaker and both iron and arsenic levels were

monitored after 24 hours interval. The control experiment illustrate that the iron level is decreased to zero in 2 days as compared to only one day required for the same water in the pond. This may be due to rise of pH of same water in the pond in contact with the soil of the pond. Thus the initial rapid decrease of Arsenic in the pond may be due to sedimentation and co precipitation with iron of the tube well water of the pond. The gradual slow decrease of remaining arsenic from the pond has to be attributed to bacterial action in the trapped pond water. The results of this experiment suggest that arsenic contaminated water from tube wells, moderate in arsenic and high in iron may be impounded in ponds in some areas in dry season, and the arsenic decontaminated water can be used by villagers after boiling and/or filtration. Very large amount of water may be decontaminated by a very simple process. However this has to be tested in different areas of the country over longer periods of time (one month or more) for reproducible results.

The arsenic in tube well water can be reduced to the acceptable limit by simple residence in a small pond dug on the ground. The arsenic content of the water is reduced gradually over a period of 2-3 weeks. The water can be used for cooking purposes and for drinking after boiling or any thermal process for bacteria killing. The soil bacteria present may be active for the arsenic removal.

**Abstract: 11079**

## **DIURNAL SOIL TEMPERATURE VARIATIONS AS INFLUENCED BY CLIMATE**

**Susanta Kumar De, Sanji Kumar Bauri, D. Mazumder, R. Roy and P. K. Tarafdar**

Dept. of Soil and Water Conservation; Bidhan Chandra Krishi Viswavidyalaya;

Mohanpur, 741252, Nadia, West Bengal, India. E-mail: susantade\_kalyani@yahoo.co.in

Temperature regime of bare soil adequately represent the temperature conditions of plant roots environments and influences various biophysical and biochemical process in soil through seeding emergence, germination of seeds, root growth and development, flowering, dry matter production and harvested yield. Heat absorption by incoming solar radiation at the soil surface and its conduction down the depth of soil causes the major deference of soil temperature in surface and subsurface layers. The present study aims to investigate the diurnal variations of soil temperature in some soil profiles of alfisols at various seasons of the years and to identify their relationship with various meteorological parameters.

Average soil temperature for every depth of each soil series follows in the order of Summer > Monsoon > Post monsoon > Winter. However, the variations of soil temperature for each of the soil series maintains the order of Summer > Winter > Post monsoon > Monsoon. Under each seasons the diurnal variation of soil temperature becomes highest in the uppermost layer and decreases rapidly with increasing depth. Surface soil layer starts heating immediately after sunrise while the soil layer of 20 cm and 40 cm depth starts heating after 2 and 4 hours of sunrise respectively for each seasons of the year. Increasing the depth of the soil shows progressive delay in attaining the maximum temperature. While the soil layers of 20 cm and 40 cm depth reach to the maximum temperature, the surface layer at that becomes cooler. Soil temperature furnishes significant positive correlation with air temperature and evaporation but negative correlation with wind velocity. The ordinary least square linear regression model is fitted to explain 90% of variability relating the effect of influential regression variables like meteorological parameters on soil temperature as response variables.

**Abstract: 11177**

## **CHANGES OF SOME PHYSICO-CHEMICAL CHARACTERISTICS IN HOOGHLY RIVER**

**Kallol Sarkar<sup>1</sup> and Sipra Biswas<sup>2</sup>**

<sup>1</sup>Garden Reach Water Works (GRWW), Kolkata Metropolitan Water & Sanitation Authority (KMW & SA), WB, India.

<sup>2</sup>Research Scholar, Department of Geography, University of Calcutta, WB, India.  
Email: kallol.1974@rediffmail.com, biswas.laboni@gmail.com

The Hooghly is a perennial and tidal river. Sources of its flow are the melt water from various glaciers in the Himalayas round the year and the different tributaries during monsoon. A great quantity of anthropological wastages, industrial effluents etc. enter into the river in various forms which again washed away to a considerable extent as a result of tidal effects. The natural and anthropogenical climate change has an effect on the hydrological as well as physico-chemical

characteristics of the river. This may affect the usability of the water. In and around Kolkata there are several water treatment plants which lift raw water from the river Hooghly, treat the same through several processes and cater to the people. To make it potable, the quality control testing of the river water are performed round the year and round the day. Some of them are turbidity, pH value, dissolved oxygen, hardness and alkalinity that have been taken as variables for a period of 5 to 25 years for this study. The present study has shown that turbidity is in declining fashion which is again more significant in the upstream. This may be due to increased flow of the river resulted by global warming and defensing effect of accumulated silt in the downstream. The pH and dissolved oxygen decrease during monsoon seasons due to mixing of atmospheric CO<sub>2</sub> through rainfall and increased turbidity plus consumption of more O<sub>2</sub> by organism masses in the river respectively. The pH value is higher during high tides as compared during low tides which reflect higher concentration of CO<sub>2</sub> land-ward. The pH value is found in decreasing trend which indicates increasing trend of CO<sub>2</sub> in the atmosphere in the course of the study period. Changes of hardness are found in the same order. But the change of dissolved oxygen is not significant.

**Abstract: 11178**

**CHANGING PATTERN OF TURBIDITY IN THE RIVER HOOGHLY:  
A SIGNATURE OF CLIMATE CHANGE**

**Sipra Biswas<sup>1</sup> and Kallol Sarkar<sup>2</sup>**

<sup>1</sup>Department of Geography, University of Calcutta, WB, India

<sup>2</sup>Garden Reach Water Works (GRWW), Kolkata Metropolitan Water & Sanitation Authority (KMW&SA), WB, India

Email: [biswas.laboni@gmail.com](mailto:biswas.laboni@gmail.com), [kallol.1974@rediffmail.com](mailto:kallol.1974@rediffmail.com)

The Hooghly river is connected to the river Ganga which is Himalayan-ice-fed and hence perennial. Also a number of west bank tributaries find their ways to drain the monsoonal precipitation into the Bay of Bengal through the Ganga-Bhagirathi-Hooghly river system. In this respect the Hooghly River is to experience an increased quantum of discharge water generated out of enhanced precipitation and rapid recession of ice-caps which are attributed to long term effects of climate change due to global warming. Increased precipitation and deglaciation may be responsible for accelerated soil erosion of the related basins which ultimately change the turbidity pattern of the river with the passage of time. Last 5 to 25 years turbidity data at various locations of the Hooghly river along the 300 km tidal zone have been used for the present study. Samples were collected from a depth of about 3 to 10 meters measured from the river-water-level and 10 to 20 meters away from the banks. Data of 1 hour and 24 hour intervals, round the year were analysed to observe the variation of transparency depending on the tidal phases and seasonal conditions respectively. The findings revealed that the river water is more transparent during low tidal condition as compared during high tides irrespective of seasons. Seasonal

observations argued that turbidity is the minimum during winter and increases as summer comes ahead and gets the maximum during monsoon. The increased summer-turbidity is attributed to higher rate of glacier-melt water and monsoonal turbidity to more precipitation. The river carries suspended particles all the year long and the same get deposited and silted near to the mouth. Thus gradual accumulation of silt forms a natural barrier on the river bed which restricts ingress of high-tidal & more turbid water inward. Observed decrease of average turbidity during the study period irrespective of seasons may be due to increased amount of water-flow through the river as a result of climate change and formation of such natural barrier near to the mouth. More significant decrease of round-the-year-average-turbidity and turbidity during high tides in the upper stream may be due to formation of natural barrier also. Formation of this barrier again claims that an augmented flow to the extent of existing rates is insufficient to maintain proper navigability at the downstream. The retreat of tidal stretch and ecological impact of all these changes, however, are some important aspects for further study.

**Abstract: 11173**

#### **DYNAMICS OF CADMIUM AND LEAD IN SOME SOILS OF CHITTAGONG**

**M. G. Kibria<sup>1</sup>, M. J. Ahammad and K. T. Osman**

<sup>1</sup>Department of Soil Science, University of Chittagong, Chittagong 4331, Bangladesh  
Email: [kibriactgu@gmail.com](mailto:kibriactgu@gmail.com)

Total, NH<sub>4</sub>OAc and 0.1 M HCl extractable Cd and Pb were determined in soils of four sites of Chittagong City contaminated by city sewage (Site-I), tannery (Site- II), fertilizer factory (Site-III) and cement factory (Site- IV) and collected on profile basis and distance from the source points. Total Cd contents of soils in different sites ranged from 0 to 2.48 mg kg<sup>-1</sup> while the values for Pb varied from 7.14 to 54.31 mg kg<sup>-1</sup>. Ammonium acetate and 0.1 M HCl extractable Cd in the surface soils were in the range between 0.01 and 0.62 mg kg<sup>-1</sup> and between 0.03 and 1.66 mg kg<sup>-1</sup>, respectively. Lead contents in surface soils extracted with NH<sub>4</sub>OAc and 0.1 M HCl varied from 0.18 to 2.72 mg kg<sup>-1</sup> and 2.00 to 50.51 mg kg<sup>-1</sup> respectively. A close relationship between the total amounts of Cd and Pb and their extractable amounts with 1 M NH<sub>4</sub>OAc and 0.1 M HCl was found. The concentrations of total and extractable Cd and Pb were inversely correlated with soil pH. Strong positive correlations were observed for Cd and Pb with CEC and organic matter contents of soil.

**Abstract: 11212**

#### **SPATIAL AND TEMPORAL VARIATIONS OF ARSENIC IN THE HOLOCENE ALLUVIAL AQUIFERS OF NORTHWESTERN PART OF BANGLADESH**

**A. H. M. Selim Reza**

Dept. of Geology and Mining, University of Rajshahi, Rajshahi-6205, Bangladesh

Two boreholes and four piezometers in the northwestern part of Bangladesh were drilled and installed for collecting As-rich sediments and groundwater. Forty groundwater samples were collected from these areas for the analysis of cations ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$ ), anions ( $\text{Cl}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ), total organic carbon (TOC), and trace elements (As, Mn, Fe, Sr, Se, Ni, Co, Cu, Mo, Sb, Pb). Groundwater arsenic concentrations in the uppermost aquifer (10 to 40 m of depth) range from 2.8  $\mu\text{g/L}$  to 462  $\mu\text{g/L}$  (median 38  $\mu\text{g/L}$ ). As concentration in sediments ranges from 2-55 mg/kg in northwestern part of Bangladesh. Arsenic concentrations are highly variable with depth and location. Groundwater belonging to cluster 1 in the southeastern and southwestern portions of the study area has relatively high As concentrations (median value=67  $\mu\text{g/L}$ ). Overall, very few water wells in the study area can meet the Bangladesh drinking standard due to their elevated As content. Although there is considerable scattering in As over the entire 12 to 35m depth range of wells in Chapai-Nawabganj, arsenic concentrations greater than 400  $\mu\text{g/L}$  are largely restricted to the 24m depth of core sediments at drilling site. Arsenic concentrations in groundwater belonging to cluster 2 in the southwestern part of the study area exceed 50  $\mu\text{g/L}$ . Median arsenic concentrations (55  $\mu\text{g/L}$ ) in groundwater belonging to cluster 3 are higher than 50  $\mu\text{g/L}$ . Most wells belonging to cluster 4 in the west region contains less than 50  $\mu\text{g/L}$  of As (median value=33  $\mu\text{g/L}$ ). The temporal variations of arsenic were observed in four piezometers for the year 2008, 2009 and 2010, implying that As is gradually decreased with time in shallow alluvial aquifers in case of high concentration of arsenic but As remains constant in respect of low concentration of arsenic.

**Abstract: 11092**

**ASSESSMENT AND TREATMENT OF THE POLLUTANTS OF TANNERY EFFLUENTS USING PHYSICO-CHEMICAL METHODS**

**Manjushree Chowdhury<sup>1</sup>, M. G. Mostafa<sup>1</sup> and Ananda Kumar Saha<sup>2</sup>**

<sup>1</sup>Institute of Environmental Science, University of Rajshahi, <sup>2</sup>Department of Zoology, University of Rajshahi, Rajshahi-6205, Bangladesh  
Email: manjushree\_saf@yahoo.co.in

The leather industry is an important foreign exchange earner for Bangladesh. The leather industry in Bangladesh is concentrated in Hazaribagh area at the Southwestern part of Dhaka city. There are 206 tannery industries located Hazaribagh area, but none of them has effluent treatment plant of any leather industry in this area. They discharge a huge amount of untreated effluents which contain toxic chemicals through out the open drain, caused severe environmental pollution. The untreated effluents of all leather industries discharged into the Buriganga river and

surroundings field. The water bodies including aquatic life and various zooplankton of the Buriganga are seriously threatened. Critical level of DO in water is below 4 ppm but DO in water of the Buriganga river is zero in dry season ( Kamrangichar – Dolaikhal). So any fish or aquatic animal cannot survive in this river area. The leather industries untreated effluent contains high levels of salinity, high TSS, TDS, TS, BOD, COD, high concentration of Cr,  $\text{SO}_4^{2-}$  and other organic and inorganic components. The objective of the present study was to investigate the quality assessment of the tannery effluents and to reduce the toxicity using physico- chemical treatments.

The study was conducted during the year 2008 and 2009 and the tannery effluents were collected from the outlet of some selected leather industries located in Hagaribagh industrial zone three times in a year. In each time, 20 liters of sample was collected, and stored in a polyethylene container at  $4 \pm 0.1^\circ\text{C}$ . The collected samples were settle in different settling tanks for about 5-7 days and then the effluents were passed through the sand–stone filtration process and finally chemical treatment with  $\text{FeCl}_3$  were performed. The samples were analyzed for a number of physico-chemical parameters as per standard methods of APHA (1989). The heavy metals concentrations in the effluent were estimated using AAS (Shimadzu GF-AAS Modal AA- 6800) following digestion of the samples with concentrated nitric acid and perchloric acid 6:1 mixer (APHA-1998).

Analyses results of the collected samples reveal that the effluents were yellowish-brown in color, having alkaline pH, vigorously high value of BOD, COD, TDS, TSS, TS and extremely high concentration of Cr, Na,  $\text{SO}_4^{2-}$ ,  $\text{Cl}^-$  and other organic, inorganic constituents. All the parameters were highly exceeding the standard permissible limit prescribed by WHO, USPHS and ISI. The observation of this investigation indicates that the untreated leather industries effluent released into the environment, which causes serious environmental pollution and is far from optimal in attaining the safe limits of disposal. But, results obtained after treating the effluent illustrate that the percentage of removal efficiency (RE) of TSS, TDS, TS,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{NH}_4\text{-N}$ ,  $\text{NO}_3\text{-N}$  total nitrogen (TN), and Ca were obtained 97, 40, 68.10, 78.72, 70.95, 95.44, 96.41, 94.31 and 43.0 %, respectively and heavy metals concentrations of Cr, As, Pb, Cd, Zn, Cu, Mn, and Ni were 64.22, 92.29, 88.15, 94.86, 85.93, 95.94, 20.63 and 45.36 %, respectively. These results reveal that the removal efficiencies of various physical and chemical parameters are considered to be satisfactory. The analyses results obtained after the treatment show that most of the physical and chemical parameters were below the standard permissible limit prescribed by WHO, USPHS and ISI. Hence, the results of this study seem to have a promising future for tannery effluents treatment. The results suggest that chemical treatment with  $\text{FeCl}_3$  after subsequent settling could be suitable for the treatment of tannery effluent.

The arsenic in tube well water can be reduced to the acceptable limit by simple residence in a small pond dug on the ground. The arsenic content of the water is reduced gradually over a

period of 2-3 weeks. The water can be used for cooking purposes and for drinking after boiling or any thermal process for bacteria killing. The soil bacteria present may be active for the arsenic removal.

**Abstract: 11237**

**IMPACT OF GROUNDWATER IRRIGATION AND 'NORTH RAJSHAHI IRRIGATION PROJECT'-A DEVELOPMENT OPTION FOR CONJUNCTIVE USE OF SURFACE AND GROUND WATER IN BARIND AREA, NW BANGLADESH**

**Chowdury S. Jahan and Quamrul H. Muzumder**

Department of Geology and Mining, University of Rajshahi, Bangladesh

To improve the quality of peoples life by achieving self-sufficiency in food through agricultural growth, the Barind Integrated Area Development Project (BIADP) under the Barind Multipurpose Development Authority (BMDA) was launched nearly three decades back in barren agro-based landscape (elevation: 15-45m AMSL) of Barind area in NW Bangladesh covering 7500 km<sup>2</sup> area. Although the area belongs to humid region but meager rainfall results in harsh climate with high temperature in summer. Due to scarcity of surface water, presently 74% (0.55 mha) area is being mostly irrigated by groundwater through 8000 deep tubewells (DTWs) and 96,000 shallow tubewells (STWs) boosting cropping intensity from 117% to about 200% (national average: 174.6%). Recurring prolonged draught and inadequate irrigation reduces yield of *boro* paddy by about 50%. Since the start of BIADP, average rainfall has an increasing trend (1.68-4.90 mm/year) in the southern portion, but in the northeast trend is reverse (-0.46 mm/year). During this period, due to lack of replenishment and over exploitation of groundwater water table progressively declined (average -0.10 m/day) turning the area into zone of low groundwater potential where northern part creeping towards semi-aridity. So the available groundwater resource must not be used indiscriminately and proper resource management approach with ecological balance must be warranted. Consequently, the strongly felt need for sustainable solution to this woe has led to the search for year-round dependable source of irrigation water that can be supplied from the river Ganges (Padma) as strong social demand by vulnerable people. Accordingly, the Bangladesh Water Development Board (BWDB) in collaboration with the Japan International Cooperation Agency (JICA) in 1988 (revised in 2005) proposed the North Rajshahi Irrigation Project (NRIP) aimed to increase food production and rural development. Here the Ganges water will be boosted to 52.50 km long main canal and later diverted into field network through 1563 km long secondary to tertiary canals by gravity drainage. In the NRIP area average yearly discharge (588 Mm<sup>3</sup>) of groundwater is 12.57% higher than potential recharge (576 Mm<sup>3</sup>) and withdrawal (220 Mm<sup>3</sup>) is higher than available recharge (196 Mm<sup>3</sup>), so scope for further expansion of groundwater irrigation has reached extreme limit.

The maximum water required for the Project from the Ganges (80 m<sup>3</sup>/sec) will be enough for both dry season and supplementary wet season irrigation. BMDA is operating large number of DTWs (2291 no.) and STWs (12785 no.), which irrigate about 65,380 ha land in NRIP area. So looking at demerits of groundwater irrigation, a development option for conjunctive use of surface water from the Ganges and groundwater from BMDA's DTWs can be proposed. About 1,33,700 ha of land can be brought under supplementary irrigation during Kharif-II (post-monsoon), and Kharif-I and *Boro* seasons (dry season), where BMDA is already irrigating 58,900 ha. So the rest area can be benefited from river water irrigation. In NRIP, the expected rate of internal economic return will be 16.4% along with positive impacts in income, employment, land values and captive fishery.

**Abstract: 11066**

**DEVELOPMENT OF NEW EFFLUENT TREATMENT PLANT (ETP) ON DYEING AND TEXTILE WASTEWATER TREATMENT FOR THE PROTECTION OF CH<sub>4</sub> GAS EMISSION TO THE ATMOSPHERE**

**M. Shohidullah Miah<sup>1</sup>, MA Rahman<sup>2</sup>, Razaul, Rajib Kumar Roy<sup>3</sup> and MA Miyan<sup>4</sup>**

<sup>1</sup>College of Agricultural Sciences, International University of Business Agriculture and Technology, Uttara Model Town, Uttara, Dhaka, Bangladesh, <sup>2</sup>Central for Global Environmental Culture (CGEC), IUBAT, <sup>3</sup>College of Agricultural Sciences, IUBAT, <sup>4</sup>IUBAT, Uttara Model Town, Uttara, Dhaka, Bangladesh

The riverine system near of Dhaka city is facing severe long-term aquatic environmental pollution primarily caused by direct discharge of liquid of textile wastewater in the waterways. Most of the textile industry discharge the polluted textile wastewater directly into the waterways due to high costs of treatment process. To minimize the cost effective treatment process a pilot scale treatment process has been setup at Mascom Composite textile dyeing factory, Gazipur, Dhaka. The treatment process consisted of a combined process (anaerobic and bio-filtration process). The anaerobic process followed by Up-flow Anaerobic Sludge Blanket (UASB) process and Bio-filtration was maintained by polyurethane materials followed by down-flow process. The pilot scale test is successfully operating without the chemical treatment process being thus more economic than the traditional chemical alternative.

The raw textile wastewater is highly polluted with the characteristics of high alkaline in nature, pH=9-10, suspended biomass SS= 2000-2500 mg/l, Chemical oxygen demand, COD<sub>t</sub> = 1200-1500 mg/l, and biological oxygen demand, BOD<sub>5</sub>= 500-800 mg/l. Significant reductions were achieved under this system in final effluent in COD<sub>t</sub> (95-98%), BOD<sub>5</sub> (97-99%) and SS biomass (94-96%).

**Abstract: 11230**

**THE POSSIBLE CERTAINNESS OF CULTURE: BEYOND THE BIOLOGICAL EXPLANATIONS OF EPIDEMIOLOGICAL DISEASE AMONG INDIGENOUS POPULATION OF FORMOSA PROVINCE (ARGENTINA)**

**Anatilde Idoyaga Molina**

Centro Argentino de Etnología Americana – CONICET, Avenida de Mayo 1437,  
1° “A”, (1085) Buenos Aires, Argentina  
E-mail: caea@speedy.com.ar

This paper analyzes the result of two epidemiological researches carried out among white and Indian population of Formosa Province (Argentina). The first research shows a prevalence of chagas among indigenous people compared to white people, which may be understood in terms of environment. The study also shows a meaningful prevalence of chagas disease among the Mataco Indians compared to Pilagá Indians, which may be not explained in biological or ecological terms. The second research notes that hepatitis among the Pilaga Indians becomes a chronic suffering in the case of male population, at the variance of what occurs in the case of women. Considering the first results, the author explores the incidence of the strategies carried out facing the situation of contact with the white by both the Mataco and Pilaga Indians. It is worth mentioning that the author predicted the results before knowing them. Regarding the second case, the author focuses on the gender differences with respect to indigenous contact with the whites. Finally, she reflects on the boundaries of biological conceptions of disease and the relevance of considering emotional and social factors, derived from the situation of contact with the dominant society, which incorporated the cultural ethos of traditional societies.

**Abstract: 11244**

**WHY BANGLADESH IS ALWAYS FLOODED?: CRITICAL REFLECTIONS ON THE IMAGE OF SOUTH ASIA IN GEOGRAPHY CURRICULUM AND TEXTBOOKS**

**Hakhee Kim**

Social Studies Education Department, Gyeongin National University of Education  
Seoksoo-Dong, Ahnyang Shi, Gyeonggi-Do, S. Korea  
Email: pippi@ginue.ac.kr

This paper is to address the stereotypical images of South Asia in world geography curriculum and textbooks. A survey of students was undertaken to identify their images on South Asian and trace the origin of prejudices and stereotypes. Structured questions were used to collect them and multi-attribute approach has been used. Attributes were selected based on sentences and photos in the various geography materials and textbooks as well as news and articles about South Asia in the media. The images of South Asia seem to be based on negative attributes rather than positive ones. They are mainly related to mysticism, political instability, grinding poverty,

illiteracy, terrorism, unemployment, lack of social services, insanitary environment and corruption. British geography textbooks have been playing a crucial role for students to form a negative image on South Asia since British imperialism dominated the world. Imperialistic and Eurocentric geographical imaginations turn out to persist in current geography curriculum and educational materials of Asian countries as well as UK. Recently, Bangladesh has been highlighted by the global media and academia as one of the most-threatened countries in global warming. As a result, Bangladesh tends to appear more often in British and Asian geography material and textbooks without a detailed explanation or proper educational context. They only use Bangladesh as a case study to address the environmental disasters and climate issue, just focusing on the scientific data and victimizing the marginalized, not to mention the dynamic global inter-connection. These negative images can hamper fair meta-geography formation and prevent students from appreciating the deep culture and diverse aspects of Bangladesh and understanding environmental issues in a proper way.

**Abstract: 11240**

### **SPATIAL CULTURAL HERITAGE OF PULAU PINANG: IT'S PROBLEM AND PROSPECT**

**MJB Moral<sup>1</sup>, Ruslan Rainis<sup>2</sup>, Kamarul Ismail<sup>2</sup> and Abdul Manaf Bohari<sup>3</sup>**

<sup>1</sup>University of Rajshahi, Bangladesh, <sup>2</sup>Universiti Sains Malaysia, <sup>3</sup>University Utara Malaysia  
Email: jahanboksh2@yahoo.com

The main objective of this paper was to highlight the spatial distribution of the selected corecultural heritages in Pulau Pinang, Malaysia. Secondly, the study investigated the prospects, problems and susceptibility of the heritages. This paper described a methodology that identified the spatial location of heritage habitats. In addition the selected appropriate spatial data sets were explored from published and field investigated information. Finally, several suggestions were made on how to utilize the GIS as a platform for managing the heritages of Pulau Pinang with hope that it would be maintained for ever, especially for the future generations.

**Abstract: 11115**

### **ENVIRONMENT, THE CREATOR AND DESTRUCTOR OF HUMAN CIVILIZATION**

**S. K. Raut**

Ecology and Ethology Laboratory, Department of Zoology, University of Calcutta, 35,  
Ballugunge Circular Road, Kolkata- 700019, India  
Email: srimantakraut@gmail.com

Climate change is a natural phenomenon. We, the *Homo sapiens sapiens*, being one of the biotic components of the global ecosystem are lamenting for our activities which are inducing changes in the earth's climate. But certainly, our activities are very much influenced by the Darwinian philosophy "Struggle for existence and survival of the fittest". Therefore, production of prodigality has not only compelled us to follow the path of "Industrialization" but also the tract of "Green Revolution". It is in the air that, our ensured-survival-activities threatening us with the

dangerous consequences of thermal expansions, glacier melting. Greenland ice sheet melting and Polar ice sheet melting. Very soon we are to redraw our global map perhaps excluding many coastal cities and ports and islands from the existing map. Of course, it is our challenge to keep the earth safe from such disturbances. Therefore, we are much vocal for safe and effective actions.

Now, let us be rational. Are we going to face the climatic hazards, if at all, for the first time in the history of *H.s.sapiens* evolution? No, we had to face the destruction of “water civilization” in Egypt along the Nile River and the Indus along the Indus river system because of desertification of the territories concerned. Like our present day apprehension the “Mayan civilization” in the western hemisphere collapsed suddenly during the tenth century because of rise of temperature and change in climate in the region concerned. Also the collapse of the Mali civilization in Africa in the fourteenth century was attributed to severe changes in climatic factors.

Thus, it is concluded that climate change is obvious and should not be challenged by any component of the ecosystem. In spite of that, we must study the various aspects of environment only to ensure our survival but not to manifest our activities, at least over natural power. It is the environment which creates human civilization and collapses the same.

**Abstract: 11245**

## **GLOBAL WARMING AND THE BOGEY OF NOAH’S DELUGE IN BANGLADESH**

**Md. Abdur Rahman**

Treasurer, Rajshahi University

The modest purpose of this paper is to present an ‘easy to understand’ analysis of an otherwise very difficult subject of global warming and its consequences for the biosphere in general and for the low-lying countries in particular.

The paper is expository, rather than exploratory in nature, it deals with the main tenets of contemporary hypotheses of global warming but does not aim at offering any new hypothesis at all. None the less, the paper may be considered a critique of these hypotheses since it focuses on the one-sidedness of these popular hypotheses which consider anthropogenic actions of using too much of fossil fuels as the ultimate cause of continued increase in temperature on the earth-surface. These hypotheses leave much to be desired because they do not take into consideration many other factors / phenomena in the solar system or in extra terrestrial zones of the universe which might also contribute to the recent increases in temperature all over world. The paper has also pointed out the fact that most of the conventional hypotheses do not make any mention of

many natural phenomena which are capable of neutralizing the so called green house effects of carbon dioxide concentration in the atmosphere.

In this paper I have stated that ample evidences are not there to make sure that the Antarctica snow has already started melting and consequently sea levels are rising. More evidences are needed to put the claim of Antarctica snow melting on solid footing. Lastly to do justice to the title of the paper a short but succinct description of the utter wretchedness of the economy of Bangladesh has been made towards the end of this paper.

Considering the location of the country, its soil profiles, topographical features, nearness to the great Himalayas “The Permanent abode of snow” and not very far from the dangerous ‘Bay of Bengal’ and being subjected to whims and caprices of the monsoon wind – the country is very much in the most risk – zones of the biosphere and its economy is externally vulnerable. Smallness of the country size and astonishingly largeness of its population size compel nearly one quarter of its population to live in river beds and other watery environment. A very slight rise in sea level would render millions of people homeless, hearthless & jobless. Sea level rise will engulf nearly 1/5 of the lithosphere, will reduce economically useful land, reduce cropping intensity by extending flood in time & space & will introduce various uncertainties – all of which will put the economy in great chaos & jeopardy escape from which will not be easy at all. The country therefore, stands badly in need of undertaking various disaster controlling measures well in advance so that millions of people are not caught, unaware by the imminent danger of global warming.

**Abstract: 11105**

### **CLIMATE CHANGE AWARENESS AMONG HIGHER SECONDARY LEVEL STUDENTS: A STUDY IN TANGAIL DISTRICT**

**S.A. Mamun\*, M. H. Rahman, A. S. M. Faysal, S. Yasmeen and M. Kar**

Department of Environmental Science and Resource Management, Mawlana Bhashani Science and Technology University, Santosh, Tangail-1902, Bangladesh.

E-mail: shamim084du@yahoo.com

A study was conducted to observe the higher secondary school student’s awareness about climate change and its causes and effects on Bangladesh. One hundred and ten students were selected through the purposive sampling technique from five higher secondary schools of Tangail district, Bangladesh. Students consisted of 63 girls and 47 boys. It is observed from the study that the concept about global environment issues as well as Bangladesh perspective like green houses gases, acid rain, ozone layer depletion, global warming and climate change was below medium. The study result revealed that about 36% student said that CO<sub>2</sub> is the only green

house gas where 25%, 10%, 10% and 6% defined CFCs, SO<sub>x</sub> and NO<sub>x</sub>, H<sub>2</sub>O and CH<sub>4</sub> respectively as green house gas but only 13% students could say that all of these gases are green house gases. Opinion about the effects of green house gases was temperature rise (50.90%), snow melting (19.10%), sea level rise (18.20%) and others (11.80%). Among 110 respondents only 34% know that ozone layer protect us from harmful ultraviolet ray where 35% identified CFCs are mainly responsible for ozone layer depletion. About 47% students understand global warming as increasing atmospheric temperature where about 42% think it is as a result of pollution and about 43% identified increasing green house gases are main cause for global warming. To define climate change simply about 39% students said it is seasonal change over a long period of time where about 42% students said climate change is environment change. To improve the present status of climate change majority of the students (43.6%) suggested of planting trees. The study result showed that the overall knowledge of the students of higher secondary school about climate change and its effects on our country are not satisfactory. Subjects related to climate change, its impact both locally and internationally and mitigation ideas should be incorporated in higher secondary school level so that students can understand and actively take part in climate change mitigation activities. Results also showed that age, sex, study group, religion and number of family members had no effect on environmental awareness of higher secondary school students.

**Abstract: 11200**

## **REVITALISING THE VISTAS FOR COMBATING THE CLIMATE CHANGE IN THE THIRD WORLD COUNTRIES**

**K. Pradhan**

Department of Agricultural Extension, Uttar Banga Krishi Viswavidyalaya  
Pundibari, Cooch behar, West Bengal-736165, India  
E-mail: [kausik\\_pradhan@rediffmail.com](mailto:kausik_pradhan@rediffmail.com)

In the present global context, the increased carbon di oxide, carbon monoxide and green house gas emission due to judicious use of fossil fuel and high value agriculture along with deforestation is playing the pivotal role in triggering the out break of global warming and climate change. The earth's climate is constantly changing over time. The first theory of climate change on global warming came in 1824. The warming in the last fifty years is almost twice (0.13<sup>0</sup>C per decade) that of the last hundred years. The Co<sub>2</sub> level in the atmosphere is 385 ppm in the summer of 2005, a level never reached in the last 650 thousand years. It is fundamentally accepted that planet wide environmental degradation has been occurring largely due to unscientific anthropogenic activities. Such unwise actions of humans are believed to have consequently

accelerated the process of global warming. The present paper attempts to examine and understand some of the causes, implications and strategies to cope the alarming global issue, climate change in the third world countries. The paper is primarily an exploratory type of research study wherein the conceptual framework is drawn from the published research papers on the issue incorporating the inference of the researcher. The present paper has explored the worst impact of global warming and climate change in the third world countries like melting of glaciers, ice sheets, glacial lake outbursts, permafrost degradation, rise in sea level, flooding and dwindling, decreasing supplies of water for drinking, farming, loosing of habitats, change of season for cropping system, longer growing season of crop, increased infestation of pest and diseases, decreased agricultural productivity, adverse effect on biodiversity and human health, increased social entropy etc. To reduce the ill effects of climate change the global projects are Clean Development Mechanism on the basis of Kyoto Protocol, Carbon credits and emission reduction projects etc. For coping the situation the future strategies against climate change may be the mitigation with the help of CO<sub>2</sub> production reduction, Carbon sequestration and adaptation in terms of ecological, economic and social, environmental adjustments. The agro-forestry system can clearly explain the mitigation and adaptation strategy in a nut shell. So, the synergy between the adaptation and mitigation can only control the rapid growth of climate change in the third world countries like India and Bangladesh. Agro- forestry can help in reduction of CO<sub>2</sub> production and carbon sequestration due to aforestation which are the mitigation strategies and it also helps in planting, mixing of biodiversity, finding adaptive genotypes, income diversifications which are the adaptive strategies. The mangrove plantation in coastal areas can also explain the synergy of the strategies for combating the climate change in the third world countries.

**Abstract: 11129**

**EXTRACTION AND DETECTION OF SOME ESSENTIAL AMINO ACIDS FROM  
*PERIONYX EXCAVATUS* FOR NATURAL MEDICINE**

**Mohammad Abdul Momith Azad, Md. Sarwar Jahan and Md. Redwanur Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi-6205 Bangladesh  
E-mail: redwan\_rahman@lycos.com

The experiment was conducted in the Environmental Microbiology Lab, Institute of Environmental Science (IES), Rajshahi University, Bangladesh for one year to study the determination essential amino acids in earthworm tissue. Special types of earthworm *Perionyx excavatus* were collected from the garbes area of Rajabari dairy farm, nearer to Rajshahi City Corporation area and then reserved it for stock culture in manure ring in front of the Institute of Environmental Science (IES), Rajshahi University. At the end of the culture period, about 900gm of *Perionyx excavatus* were collected by hand sorting method, thoroughly wash several times by

distilled water to evacuate the residual undigested contains in their guts properly. *P. excavatus* was then weighed, balanced in hot water, re-weighted and oven-dried at the temperature of (60-70) °C. After drying, it were weighed and then milled with a grinder machine into powdered form. Different solvents used for the extraction out. In the TLC system pre-coated TLC plate of silica gel were used for the determination of amino acids of the extracts. Standard sample of different amino acids were prepared by the Amino acids kit. Developed TLC plates of different sample were dried on the hot plate or in an oven. After drying the chromatogram it was viewed under ultraviolet (UV) light and a solution of ninhydrin reagent (0.3g) in n-butanol (100 ml) containing acetic acid (3 ml) is sprayed on the chromatograms and dried at 60°C for about 20 min or at 100°C for 5-10 for the determination of amino acids. By following this above method and estimating Rheumatic fever values nine essential amino acids, Arinine, Cysteine, Histidine, Lysine, Methionine, Phenylalanine, Tryptophan, Threonine and Valine were isolated form the Methanilic and Ethanilic extracts of *Perionyx excavatus* tissues. Extracted medicinal active compounds from earthworm tissue should be identified with their chemical structures for industrial production.

**Abstract: 11180**

## **OLDER PERSONS AND DISASTERS: CHALLENGES AND OPPORTUNITIES**

**A. S. M. Atiqur Rahman**

Institute of Social Welfare and Research, University of Dhaka, Dhaka 1205, Bangladesh  
E-mail: atiq\_du2008@yahoo.com

Dramatic changes in climate and demography in recent years Bangladesh is confronting unprecedented intimidation of disaster and population ageing. Both occurrences are increasing alarmingly and become a threat to its development. Considering its geography, climate, population, governance, politics and culture Bangladesh is one of the severely disaster prone and threatened least developed countries in the world having about 10 million older persons (OP) which will be 17 and 44 million in 2025 and 2050 respectively. Rapid growth and absolute number of OPs become a very important issue in terms of social and health policy of Bangladesh. Cumulative effects of the aforesaid environments, older persons become the mostly affected, aggrieved, distressed, vulnerable and helpless group deserve logical and right based societal intervention. So, in order to ensure sustainable development, Bangladesh needs to meet the challenges of frequent disasters and rapid growing OPs. In Bangladesh population ageing remains one of the most neglected of all issues to the policy makers; may be due to a widespread belief that traditional structures provide support to OPs. There is also a mistaken presumption that OPs are physically inactive, not open to new ideas and unable to participate effectively in community and economic activities. When considered and seen as welfare issues, OPs are

regarded as a burden on society and passive recipients of care. Lack of public awareness and information about OP's contributions, circumstances, issues or needs create negative images of ageing. Recent research highlights the valuable roles OPs play in emergencies and the economic and social contributions they make. Reducing the vulnerability of OPs is not primarily about creating special services for them rather to ensuring that they have equal access to vital services that relies on making service providers more aware of the particular problems and obstacles they face. It means including OPs in the planning and delivery of services and supporting their capacity to live independent lives once the emergency has passed. Successful interventions encompass both the welfare and rehabilitation of OPs, and address these needs in the context of their families and communities. OP's responsibilities and knowledge base should be recognized and built on. Their earlier emergency experiences, coping strategies, traditional skills and local environmental knowledge are important in mitigating the impact of disasters. Ageing experts made suggestions aiming to achieve increase of intergenerational solidarity in disaster situations, inclusion of OPs in all disaster management measures, utilization of OP's experience in disaster risk reduction, making relief distribution systems more older OP's friendly, taking OPs friendly rehabilitation measures, using cash support in emergencies etc.

Present paper is an attempt to have a discussion on the current disaster and ageing condition, their challenges and threats, strengths and opportunities, and traditional and modern intervention systems in Bangladesh in the context of global climate change situation.

**Abstract: 11181**

## **SITUATION OF WOMEN IN DISASTER AFFECTED COASTAL AREAS OF BANGLADESH**

**Niger Dil Nahar**

NGO Capacity Building & Disaster Management Unit, Shapla Neer, 19/13, Iqbal Road,  
Mohammadpur, Dhaka 1207, Bangladesh  
E-mail: nidina25@gmail.com

In Bangladesh, women of coastal areas are becoming the major victim of environmental degradation resulting from recent global climate change. With a population of 160 million, of whom around 20 percent are living in coastal areas, Bangladesh is prone to disasters of various types due to its very geographic location, dense population and the phenomenon of global warming. In particular, its coastal areas are susceptible to natural disasters caused by cyclone and

tidal surge due to the very shape of its southern coast which tends to draw in and intensify cyclone storms to a great extent. Unfortunately, there are often substantial differences in the knowledge, skills, social formations of women and men in Bangladesh, and also in access to and control over the resources required for food and livelihood security as well as for over all social empowerment. Women are severely marginalized all over Bangladesh, but the problem is much more magnified in coastal areas where life is very tough, hard and conservative, women are fairly house-bound and hardly participate with men outside the family. They attend to children and other family members, and do all the household works but their jobs are still unrecognized and non-remunerative. Surprisingly, their indigenous knowledge and practice of environmental management increases the coping capacity of families and even communities in hazardous areas and thus contributes to their survival. But men are heads of families and community matters which leave women disempowered; also strict compliance of Purdah limits their participation in community activities. Having limited scope in receiving disaster related information women can hardly get prepared for disaster management. Numbers of women lost their husbands who go for fishing in rough weather and by the attack of pirates in deep sea, reasonably they become critically vulnerable and start struggling unprecedentedly for survival. Not only in the super cyclone SIDR (2007) or silent killer Aila (2009), women of the coastal areas of Bangladesh spend their days encountering poverty, discrimination, uncertainty and fearful action of nature and society. Interestingly, women of these areas are surviving, living with disasters although with their small capacity, indigenous knowledge and unique strategies. Their knowledge and skills in plantation, homestead gardening, cattle and chicken rearing, food and seed preservation, entire process of crop production etc. play a crucial role in disaster management. Their role and contributions to the survival of their families as well as communities in a hazardous and volatile situation is praiseworthy. So, concern groups must recognize, honor, value and use the resources of these women in disaster risk reduction and environmental management.

Present paper attempts to discuss the sufferings, challenges, life straggles, capabilities, resources and resiliency of women of Bangladesh coastal areas and examines the available support services from the community and government.

**Abstract: 11078**

## **ENVIRONMENTAL IMPACT ASSESSMENT OF FARAKKA BARRAGE ON PADMA RIVER, BANGLADESH**

**Md. Moshiur Rahman and Md. Redwanur Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi-6205, Bangladesh

E-mail: mrsplendid07@gmail.com

Bangladesh is a riverien country. The pride of Bangladesh is for her water ways. A lot of small and big river are spread all over the country like vein and nerve. These rivers play an important role in the economic development of the country and also keep the environment balanced. Padma is a big river and has a great role for the socio economic development of our country. Some 12 districts of north western side of Bangladesh are directly or indirectly influenced by the effect of Padma river. The importance of this river is unlimited. About fifty lakh people of north and western part of our country are benefited by Padma river. Besides this Padma river act as the large source of water in this region that is used specially for agriculture, industrial function and also domestic use. Some other five rivers like Gorai, Tista, Atrai, Modhumati, Arial Khan gets water from Padma river. Thirty million lives are affected through environmental and economical ruin. An estimated annual economic loss of over half a billion dollars in agricultural, fisheries, navigation and industries. This river is also a large source of fishes and other aquatic animals. About three million people are engage fishing from Padma river for their livelihood. But unfortunately this river is deeply affected much by the Farraka barrage that builds by our so called neighbor country India. A numerous problems arise due to this barrage which is denoted as '*barrage of death*' for Bangladesh. The study area Rajshahi region is mostly affected as because the river crossed a vast area of Rajshahi. Agricultural production and fisheries are mostly depends upon the water flows of Padma. Frequent flooding due to environmental imbalance and changes in the natural flow of the Ganges. A lots of people fall into crisis due to effect of Farakka barrage. The weather and climatic condition of greater Rajshahi is getting very extreme as the large source of water body like Padma is going to dries up. The temperature is increasing year by year tremendously. The acerbity nature of this region is gradually rising. The biodiversity of this region get loss due to the bad effect of the barrage. This barrage is a great threat for both life and environment of about one third region of Bangladesh.

**Abstract: 11215**

## SUSTAINABLE ADAPTATION TO CLIMATE CHANGE AND DISASTER RISK REDUCTION

**Saadia Majeed**

Postgraduate Programs in Disaster Management (PPDM), BRAC University, Dhaka, Bangladesh  
E-mail: saadia\_amrin@yahoo.com

Sustainable Adaptation to climate change is the key to enabling substantial changes in the field of climate change adaptation and disaster risk reduction. The unprecedented challenges posed by climate change can be reduced through integrated and planned adaptation measures. To date,

climate change adaptation and disaster risk reduction have evolved with independent agenda in risk management. Even though the key component of sustainability is resilience to both disaster and climate changes by adapting to better withstand impacts and to more quickly recover from them. As disaster risk reduction deals with climate variability and is considered as a first line of defence against climate change impacts, conversely it must emphasize adaptation by incorporating future changes into analyses and thereby concomitantly considering both corrective risk and prospective risk. Current assessment methods seem inadequate to address both existing risks and the possibilities of new risks caused by both exogenous changes and endogenous development and short-term disaster risk reduction actions. Based on conceptual discussion and literature review this paper outlines the necessity of sustainable adaptation. It also demonstrates existing methodological gaps in assessment and evaluation processes of vulnerability and adaptations and focused on further research guidelines which are required to cope with existing inadequacy of knowledge on adaption measures.

**Abstract: 11183**

**ECONOMIC VULNERABILITY OF DISASTER IN LAND PRODUCTIVITY: A CASE FOR MONGLA UPAZILA, BAGERHAT, BANGLADESH**

**Md. Mujibor Rahman<sup>1</sup>, Mahabub-Ur-Rahman<sup>1</sup> and Mahmudul Islam<sup>2</sup>**

<sup>1</sup>Environmental Science Discipline, Khulna University, Khulna- 9208, <sup>2</sup>CDMP, Disaster Management and Relief Bhaban, 92-93, Mohakali C/A (6<sup>th</sup> floor), Dhaka 1212, Bangladesh  
E-mail: mujibku@gmail.com,

The impacts of recurrent hazards like salinity intrusion, water logging, cyclone and tidal surges, flood, drinking water crisis and virus attack in the gher farming are directly or indirectly affect all segment of life in the coastal people of Bangladesh. Mongla Upazila, the southwestern part of Bangladesh facing these intermittent hazards and their effects over the way of life. Salinity problem identified as the most serious agent for economic vulnerability in this region causes the loss of agricultural production and economic thrashing. Sector wise economic vulnerability is determined through the questionnaire survey but especial emphasis is always given to the land productivity. The cost of decreased agriculture production is determined for assessing economic vulnerability. Only decreased amount of rice production is determined for the most ranked salinity (88% respondent think salinity as a highest rank problem for decreased land productivity) problem. Decrease rate of crop production (rice kg/acre) of Mongla Upazila is 360.26 kg/acre in considering the total cultivable land 27824.55 acre affected by the salinity problem. By using the use value of cultivable land the cost of decreased net production loss is determined where total cost for decreased land productivity per year is Tk 31, 07, 44,950. Economic loss of land

productivity from two consecutive years is Tk 32, 13, 82,645. Based on the existing adaptation practice and possible best management option using by the people of study area a strategy is developed for minimizing economic vulnerability of disaster in land productivity.

**Abstract: 11104**

## **CARBON SEQUESTRATION POTENTIAL OF BAMBOOS VIS-À-VIS FAST GROWING TROPICAL TREES**

**Sanjay Singh, R. S. Prasad, Srikanti Kumari, S. P. Mishra and R. Das**

Molecular Biology and Tree Physiology Laboratory, Botany, Silviculture and NWFP Division,  
Institute of Forest Productivity, Aranyodaya, NH-23, Lalgutwa, Ranchi- 835303, India

E-mail: sanjaysingh@lycos.com

Bamboo is one of the most productive and fastest growing plants which make it a valuable sink for carbon storage. The fastest-growing bamboo species may grow up to 1.2 m a day and carbon content comprises usually about 50% of the total biomass. Thus, bamboo can easily compete with the most effective wood species in terms of carbon sequestration capacities. Bamboo has several advantages over tree species in terms of sustainability and carbon fixing capacity. Besides higher biomass, bamboo has other advantages over wood as a carbon stock. Unlike woody crops bamboo offers the possibility of annual selective harvesting and removal of about 15-20% of the total stock without damaging the environment and stock productivity. Over 90% of bamboo carbon can be sequestered in durable products such as boards, panels, floors, furniture, buildings, cloth, paper and activated charcoal. These products have a very long life span and may retain carbon for several decades. Available studies conclude that bamboo biomass and carbon production may be 7-30% higher compared to the fast growing wood species. For instance *Bambusa bambos* has been measured at a total above ground biomass 287 t/ha with a mean annual production of around 47.8 t/ha/year, almost twice that of the Eucalyptus clones. In the present study carbon sequestration potential of 10 bamboo species viz., *Bambusa bambos*, *B. balcooa*, *B. multiplex*, *B. nutans*, *B. tulda*, *B. vulgaris* var. *green*, *B. vulgaris* var. *striata*, *Dendrocalamus membranaceus*, *D. strictus* and *Sasa palmata* was evaluated in comparison with 7 fast growing tropical tree species (*Acacia auriculiformis*, *Anthocephalus chinensis*, *Bombax ceiba*, *Gmelina arborea*, *Melia azadirachta*, *Pongamia pinnata* and *Tectona grandis*). The rate of net photosynthesis varied in these bamboos from 1.55  $\mu\text{mol m}^{-2} \text{s}^{-1}$  to 10.12  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Species like *B. tulda* and *D. strictus* recorded photosynthesis rates comparable or better than many fast growing trees. The trends were similar in case of chlorophyll content and photosynthetic enzymes. The study indicates that bamboo plantations possess climate change mitigation advantage especially in the natural growing range.

**Abstract: 11097**

**CARBON SEQUESTRATION POTENTIAL IN ABOVEGROUND BIOMASS OF  
SINHARAJA TROPICAL RAIN FOREST SRI LANKA**

**M. D. P. Kumarathunge\*, P. S. Pathinayake, R. O. Thattil and S. P. Nissanka**

Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Peradeniya,  
Sri Lanka, Phone: 0094 81 2232002, Fax: 0094 81 2232131  
E-mail: dushan@ifs.ac.lk

The role of tropical forests in global carbon cycle is of paramount importance since they annually process approximately six times as much carbon as human emits from fossil fuel burn. The tropical rain forests are highly productive and carbon-dense thereby the response of this vegetation to a globally changing environment is critical in predicting the future levels of atmospheric carbon dioxide. Therefore, estimating the carbon sequestration potential of these forests is very important as a way of mitigation of the adverse effects of increasing atmospheric carbon dioxide. The objective of this study was to estimate the present aboveground tree carbon stock of *Sinharaja* forest, Sri Lanka while establishing a base to estimate the carbon dynamics in this forest.

Measurements were carried out in *Sinharaja* Man and Biosphere Forest reserve (6° 24' 40" N and 80° 30' 32" E) occupies approximately 8564 ha. This forest complex belong to the lowland rainforest formation and have been classified as Wet Evergreen Forest Climax (De Rosayro, 1950). Site stratification was done using a Landsat ETM+ image of the *Sinharaja* forest acquired in year 2005. The image was subjected to unsupervised classification using the Erdas Imagine 8.6 software. After classification, five different classes were identified based on the reflectance from different vegetation types. A total of 50, 30 × 30 m quadrats were used for sampling and at least ten plots were laid in each stratum. Here, we considered only trees which are having diameter at breast height (DBH) greater than 5 cm. the DBH and the total tree height was measured using DBH tapes and clinometers respectively. Tree measurements were converted into aboveground biomass using a general allometric model assuming tree form factor as 0.7.

According to the results, the average above-ground biomass density of the *Sinharaja* forest was 358.9± 46.9 Mg/ha. The average above-ground carbon content (assuming carbon content as 50% of TAGB) of the forest was 179.45 Mg/ha. Compared with the regional estimates, *Sinharaja* has similar results coming from the wet evergreen forests of India, Thailand and Malaysia. The results of this study emphasize the potential of the forest tree community to act as a biological

scrubber for increasing atmospheric carbon dioxide. However, it is not clear, whether the carbon fixation in this forest has reached a climax or still it increasing. Therefore, these estimates can be presented to assess the carbon dynamics of *Sinharaja* as a way of mitigating the adverse effects of global climate change.

**Abstract: 11147**

## **POTENTIAL HEALTH EFFECTS OF CLIMATIC CHANGE AND THEIR POSSIBLE MITIGATION STRATEGIES**

**Munazza Fatima and Adila Shafqat**

Geography, Department of Geography, The Islamia University, Bahawalpur, Pakistan

E-mail- [munazza.fatima@iub.edu.pk](mailto:munazza.fatima@iub.edu.pk), [munazzafatimal@gmail.com](mailto:munazzafatimal@gmail.com)

This research article is based on the theoretical analysis of climatic change factors that affects the human health in terms of disease and their possible mitigation strategies. Climate change can affect health directly and indirectly. Directly, extreme weather events (floods, droughts, wind storms, fires,. And heat – waves) can affect the health of people and cause significant economic impacts. Indirectly, climate change can alter or disrupt natural systems, making it possible for vector-, water-, and food- born diseases to spread or emerge in areas where they had been limited or not existed. Climatic change can also effect the incidence of diseases associated with air pollutants and aeroallergens. The cause- and – effect chain from climatic change to changing patterns of health outcomes is complex and includes factors such as initial health status, financial resources, effectiveness of public health programs, and access to medical care. The observation that most vector-, water- or food – born and / or animal- associated diseases exhibit a distinct seasonal pattern suggest a priori that weather and/ or climate influence their distribution and incidence.

Diseases such as Rabies and Cholera have become less widespread and diseases such as typhus, malaria, yellow-fever, and dengue fever have largely disappeared, primarily because of environmental modification and socio economic development. Water born diseases and food born disease remain highly under reported.

Realistically assessing the potential health effects of climate change and must include consideration of the capacity to manage new and changing climatic conditions. Individuals, communities, governments, and other organizations currently engaged in a wide range of actions to identify and prevent adverse health out come associated with weather and climate. Although these actions have been largely successful, recent extreme events and out breaks of vector-born diseases highlight areas for improvements.

Regional vulnerabilities to the heal impacts of climate change influenced by physical, social, demographic, economic and other factors. Adaptation activities take place within the context of

slowly changing factors that are specific to a region or population (particularly in developing countries like Pakistan) , including specific population and regional vulnerabilities social and cultural factors, the built and natural environment, the status of the public health infrastructure , and health and social services. Because these factors vary across geographic and temporal scales, adaptation policies and measures generally are more successful when focused on a specific population and location. Additional important factors include the degree of risks perceived, the human and financial resources available for adaptation, the available technological options, and the political will to undertake adaptation.

Strategies, policies, and measures implemented by community and government, federal agencies, NGO's and other actors can change the context for adaptation by conducting research to access the vulnerability and to identify technological options available for adaptation , implementing programs and activities reduce vulnerability and shifting human and financial resources to address the health impacts of climate change.

**Abstract: 11103**

### **CONVALESCE THE FOREST – TO COMBAT CLIMATE CHANGE**

**Radha Priya P., Ramachandran A. and Malini, P.**

Centre for Climate Change & Adaptation Research, Anna University Chennai,  
Chennai, Tamil Nadu, India – 600 025  
E-mail: [radhapriya.cc@gmail.com](mailto:radhapriya.cc@gmail.com)

Climate change and forests are intrinsically linked components in ecosystems. On the one hand, changes in global climate are already stressing forests through higher mean annual temperatures, altered precipitation patterns and more frequent and extreme weather events. At the same time, forests are a natural defense against climate change as carbon sink. They sequester carbon dioxide, store in their biological systems and eventually reach the soil as Soil Organic Carbon (SOC) through decomposition by microbes. Any loss in the stored SOC, will lead to degradation of forests and biodiversity. Moreover, on the flip side of the coin, when destroyed or over-harvested, burned or degraded, forests can become sources of greenhouse gas. Such a rich diversified ecological complex has been seriously degraded due to human induced problems.

Due to the continuous need based forest management like felling of trees, uprooting and burning there is complete deterioration of carbon stored in soil. Studies reveal that minimum percentage of SOC is required for the better growth and conservation of forests. SOC less than 1.8 % does not support tree growth and affects biomass production. The prime importance of this century is to restock the lost soil carbon in the soil by amending the soil with fulvic and humic acid. Unless we treat this kind of area with suitable soil amendments and microbial load, there will not be any biomass production or carbon sequestration potential even after repeated planting. To overcome

this issues all the low carbon areas less than 2% are to be identified, appropriate Rhizosphere engineering technology may be adopted to enhance the SOC, Microbial activity, NPK (macro nutrients) and Micro nutrients. Only through better forest biomass there will be better carbon sequestration.

**Abstract: 11114**

**HEAT WAVES DECREASE THE WORK EFFICIENCY AND DETERIORATE THE HEALTH STATUS OF LABOURERS EMPLOYED IN CONSTRUCTION SECTORS: A CASE STUDY TO EVALUATE THE IMPACT OF THERMAL EXTREMES, A CLIMATIC VARIABLE ON HUMAN HEALTH.**

**S. Cahtterjee, K. Sarkar, T. Tarafder, S. Sahu and G. Paul**

Environmental Physiology Division, Department of Physiology,  
University of Kalyani, Kalyani, West Bengal-741235, India  
E-mail: [gpaul.kalyani@rediffmail.com](mailto:gpaul.kalyani@rediffmail.com)

The studies were conducted on construction labourers (N=40) during the spells of heat waves and absence of heat waves in summer and in heat stress exposed animal (cat). Work efficiencies of labourers were determined from their walking speed and the amount of load handled during the work. Informations about musculo-skeletal symptoms of labourers were collected by applying Nordic questionnaire. The exertion of labourers during the work was measured by using perceived exertion rating (PER) scale. Energy expenditure of the labourers was measured indirectly from peak heart rate. Cardiovascular load and work strain were determined from average working heart rate, relative cardiac strain and recovery heart rate. Cardiac strain was determined from net cardiac cost and relative cardiac cost. Isometric contraction of muscle and single unit discharge of nerve were recorded with RMS dynograph and CRO. The walking speed of labourers with and without load, and the load handled by the labourers were significantly decreased ( $p < 0.05$ ) when the heat waves prevail than in absence of heat waves during the period of summer. In order to elucidate the mechanism of decrease in work efficiencies, the physiological stress variables of labourers during the period of heat waves in summer were observed. The physical exertion of labourers was significantly high at the time of work in hot ambient temperature owing to heat waves as per PER scale. Besides, the average heart rate during the work, relative cardiac strain, sum of recovery heart rate and the peak heart rate, net and relative cardiac cost were significantly higher ( $p < 0.05$ ) in summer during the presence of heat waves. Moreover, the percentage of recovery was significantly poor during the presence of heat waves than in absence of heat waves. These results suggest that heat waves can elevate cardiac load and thus, cardiac strain in labourers by increasing the cardiovascular stress. The poor recovery of heart rate in summer during heat wave spell suggests that heat waves increase the intensity of cardiac stress of the labourers during the work. In order to study the effects of

heat waves induced heat stress on muscular and skeletal efficiency of labourers, the Nordic questionnaire was applied on labourers. It was shown that the muscle cramp and pain in different body parts of the labourers were significantly elevated at the time of heat waves spell. In order to ascertain the effect of heat stress on neuro-muscular activity of labourers at the molecular level, the isometric contraction of gastrocnemius muscle and single unit discharge of spinal pain nerve of the cats exposed chronically by heat waves were recorded. It was observed that the discharge of pain fibres was increased and force of isometric contraction of gastrocnemius muscle was depressed significantly. This result suggests that heat waves deteriorate the health status and decrease the work efficiency of labourers by reducing the neuromuscular transmission and increasing the pain fibre activation.

It may be suggested that adequate water and electrolyte supplementation, clothing with appropriate clo values, accommodation of work-rest schedule with short rest breaks and use of head covers can improve the work efficiency of the labourers by reducing the cardiac, muscular and neural strains.

**Abstract: 11156**

## **CLIMATE CHANGE, TECHNOLOGY TRANSFER AND INTELLECTUAL PROPERTY RIGHTS**

**Saswat Subasit**

Symbiosis Law School, Pune, Maharashtra- 411 016, India  
E-mail: saswatsubasit@gmail.com

During the last few years, the debate over global climate change has transformed from a discussion regarding the validity of climate change to an acceptance that global climate change is occurring and the subsequent debate of how to deal with it. Several plans have been proposed for addressing the issue of global climate change, but the underlying principle behind all of them is the realisation that a global effort is required. The main issues of contention revolve around the interests of the developed versus developing countries and the countries which are willing to accept mandatory emission cuts versus those that are not.

Developed and developing countries are equally anxious to avoid the sort of cut-backs or restrictive energy policies, which would undermine their industrial growth or competitiveness. Every country wants solutions which are not only good for the planet, but are also good for business and development. Technology transfer from developed to developing countries, and increasingly between developed countries is seen as playing a critical role in the global response to the challenges of climate change. In this context, both the United Nations Framework

Convention on Climate Change (UNFCCC) and the Kyoto Protocol require developed countries to take a leading role in reducing domestic greenhouse gas emissions and in providing financial assistance and facilitating technology transfer to developing countries. In spite of the commitments of the developed countries under these international agreements, little progress has been made in the development and transfer of clean technology to the developing countries. This paper aims at examining the key issues involved in the transfer of technology. It shall begin by discussing the need and purpose of international technology transfer for mitigating climate change. The paper shall trace the origin and history of technology transfer for dealing with climate change. It shall then elaborate on the process through which technology transfer can take place and shall emphasise on the technological, agent and market perspectives involved in the same. The paper shall substantiate on the potential benefits arising out of technology transfer. It shall identify the problems that need to be addressed for facilitating international technology transfer and shall suggest suitable measures for dealing with them. The paper shall focus, especially, on intellectual property issues involved in the transfer of technology and attempt to devise a model which shall ensure that intellectual property rights do not become a barrier to transfer of technology in the context of climate change. The historical experience is that stronger intellectual property protection laws act as obstacles in technology transfer and technology absorption. Developing countries need both development and access to technologies that will facilitate the transition to less carbon intensive economy within the next two or three decades, therefore, intellectual property issues in technology transfer need to be tackled by a combination of policy measures, incentives and bringing in changes in the global IP regime. The paper shall conclude by making recommendations for the effective implementation of strategies related to technology transfer for combating the problem of climate change.

**Abstract: 11226**

## **STATUS OF COMPOSTING IN INDIA - AN INDIAN EARTHWORM'S EYE-VIEW**

**Sultan Ahmed Ismail<sup>1</sup>, Priscilla Jebakumari<sup>2</sup> and Dhakshayani, C.<sup>3</sup>**

<sup>1</sup>Ecoscience Research Foundation, Chennai 600041, India and Department of Biotechnology, The New College, Chennai 600014, India; <sup>2</sup>Stella Maris College, Chennai 600086; India

<sup>3</sup>R&D, Harita-NTI, Ambattur, Chennai 600 058, India

E-mail: sultanismail@gmail.com,

Tonnes of waste are generated especially in cities of India. Lack in segregation at source causes inconvenience in the proper handling of waste. Chennai (formerly Madras) city alone generates 3500 tonnes of garbage per day, and if the developing new extension areas around Chennai are included then the total quantity of garbage generated is about 5900 tonnes per day. Most of it in its un-segregated form is disposed in open disposal yards. Growing ecological awareness

amongst the citizens now has made them accept composting of organic waste at source as meaningful.

Several methods of composting are in practice in India such as the anaerobic pit composting, Indore method, NADEP method, biodung method and vermicomposting, to name a few. Recent results and progress in handling of wastes at the domestic level, community level and industrial level; both in terms of compost as a viable solution in solid waste management, as well as compost production as a viable micro-enterprise functioning as income generation programs for the rural folk will be presented. Beneficial use of this compost in organic farming as well as in soil bioremediation will also be summarised.

A complete succession of micro organisms comprising of bacteria, fungi, actinomycetes and algae as well as the change in physical and chemical parameters during the composting process (biodung followed by vermicomposting) shall be presented. Some of the successful models in composting of industrial sludge to enable total solid waste management with appropriate bulking materials in Industry shall also be presented. A classical example of composting done in improvised cement tanks at the Police Residential Quarters shall be highlighted. There is a tendency in most households to dispose their organic waste in polythene bags, which in fact hinder the composting process and the contents rots than compost.

Biodegradable plastic bags: The introduction of biodegradable plastic bags (Harita-NTI Ltd) as an experimental measure for disposal of organic waste by households of the Police Residential Quarters in fact supports composting when they are put into compost units and sheared open. This process along with the possible role of such bags in future solid waste disposal shall be briefly summarised.

**Abstract: 11122**

## **VEGETATION ANALYSIS OF A NEWLY FORMED ISLAND IN (INDIAN) SUNDERBANS AFFECTED BY CYCLONE 'AILA' -- A CASE STUDY**

**S. Saha, P.Mandal and M. K. Barai**

Ecosystems Analysis Laboratory, Post Graduate Department of Botany  
Barasat Government College, Barasat, Kolkata – 700124, West Bengal, India  
E-mail: san204in@yahoo.com

The Sunderbans is the largest single block of tidal mangrove forest in the world spreading over India and Bangladesh. The delta has been built up by the deposition of soil particles carried down by the river systems from the Himalayas, giving rise to complex net work of tidal channels and inter-channel mudflats. Being an 'ecotone', mangroves perform many important roles – among others being protection of coastal and inland population against natural calamities. In this context, vegetation studies were carried out in a newly formed island (22° 09' 00" N and 88° 51'

00" E), about 4 Km north-east of Sajnekhali Wild life Sanctuary in the (Indian) Sunderbans. This unnamed island of 0.577 Km<sup>2</sup> (during low tide) had come into existence within the last 8 years in the Gomor river. Approximately 8% of the island had forest cover and vegetation analyses were carried out by laying quadrates of appropriate size and number in 2008 (1<sup>st</sup> Study, S1) and then again after the severe cyclonic storm 'Aila' in 2009 (2<sup>nd</sup> Study, S2). This was done to assess the change or damage to the species composition, density and diversity of the vegetation due to the storm. During S1, 9 species were recorded out of which 7 sp. were 'True Mangroves' (all tree sp.) and the other 2 sp. were 'Mangrove Associates' (a shrub and a grass)). Tree density was 8600 stems/hectare. The two *Avicennia spp.* collectively had high IVI value of 141.63, while rest of the trees together had merely 93.90 IVI. The pioneer colonizer grass, *Porteresia* had 50.02 IVI and density was 0.64/m<sup>2</sup>. During S2, 13 species were recorded out of which 10 sp. were 'True Mangroves' (all tree species) and 3 sp. were 'Mangrove Associates' (a climber, an herb and a grass). Tree density was 14760 stems/hectare. The three *Avicennia spp.* collectively had IVI value of 107.44 while the rest of the trees together had 94.15 IVI. *Porteresia* had exceptionally high IVI (91.42) and density was 7.28/m<sup>2</sup>. The species composition was typical of the 'Flora of Formative Island' and indicated '1<sup>st</sup> and 2<sup>nd</sup> Category of Mangrove Zone Succession'. It also indicated transition from 'Riverine Flat' to 'Mature Ridge Forest', though the storm appears to have effected a retrogressive succession. The similarity coefficient between S1 and S2 was 54.56% but there was reduced species diversity from 2.33 (S1) to 1.59 (S2) and increased concentration of dominance from 0.258 (S1) to 0.684 (S2). While the effect of 'Aila' was severe on human life and property there appear to be a mixed action on the vegetation cover with lowering diversity but increasing density.

**Abstract: 11124**

**CLIMATE CHANGE AND THE CRISIS OF BIODIVERSITY- CHANGING LIFE OF THE TRIBAL PEOPLE: A MICRO STUDU ON THE LODHAS AND THE SANTALS OF PASCHIM MIDNAPUR**

**Samita Manna**

Department of Sociology, University of Kalyani, Kalyani 741235, Nadia, W.B., INDIA,  
E-mail: samita.manna@gmail.com

Climate change is a burning problem in recent time. It is a biggest threat to the world's environment with devastating consequences for humans, animals and ecosystems. The impact of climate change on human life is manifold. No one can deny the other important associated factors like industrialization, de forestation, technological and other economic facets which are coupled with the changing life of the people.

Biodiversity is people's resource especially for the poor of the Third World Countries. They have to depend on the natural resources for food, shelter and other essentialities of every day life.

The poor tribal people who are till today in back from the main stream population live in different rural areas not far from the jungles. The rich biodiversity has enabled them to sustain their life for many years. As a result, the tribes are now in transition. The dualities of tradition and modernity create many social, economic and cultural threats in their life of which climate change is a central one.

The study has been conducted on the two ethnic groups- the Lodhas and the Santals of Paschim Midnapur of West Bengal. The wife of the head of the family is considered for the purpose. In this way 50 Lodhas and 50 Santals from different families of various villages of the Narayangargh Block have been chosen for the study. Besides a few medicinal men locally known as Gunins, are also considered.

The major objectives of the study are as follows:i. to observe the reactions and perceptions of the tribal people on climate change. ii. to find out various problems faced by them due to crisis in biodiversity. iii. to find out the nature of their coping strategies and alternative mode of adjustment for their sustainability. The data were collected through interview method.

The schedule consists of various questions related to the stated objectives of the study. The data have been collected from March 2010 to June 2010.

The tribes have been facing severe problems in their daily life due to climate change and degradation of biodiversity. Their socio economic life is affected greatly. The children are affected with various diseases. Modern medicines are often out reachable and traditional medicines are eroding due to climate change and its impact on biodiversity. Finally, it can be said that biodiversity is not simply a crisis due to disappearance of species but it threatens the livelihood of millions of people in general and the tribes in particular.

**Abstract: 11160**

## **IMPACT OF GLOBAL CLIMATE CHANGE ON THE DIVERSITY OF FLORA AND FAUNA OF THE EAST KOLKATA WETLANDS, W.B., INDIA**

**S. Guchhait, S. Kundu, and C. K. Manna**

Endocrinology Laboratory, Department of Zoology, University of Kalyani,  
Kalyani 741235, Nadia, W.B., India  
E-mail: manna\_kly@sify.com

Over the past few decades, global attention has been drawn to the broad issue of global change and specifically, global climate change. It is the complex and uncertain nature of this issue which has spurred considerable debate at national and international levels, as well as a quest for scientific data or proof. It is demonstrated and accepted that human activities are largely responsible for the current trend in climate change. It is certain that climate plays an important role in the health, functioning and distribution of wetlands, how variations to it such as global

warming will impact on wetlands is difficult to assess given the multitude of causative variables and their interplay over time.

East Kolkata Wetlands are a complex combinations of natural and human made wetlands lying east of the city of Kolkata. Spread over 140 sq km of salt marshes, meadows, ponds, lakes, canals and swamps, they are the kidney of the city. It provides livelihood to 90,000 persons engaged in fish cultivation via 'bheries' and 10,000 farmers who grow vegetables and paddy on small plots. In the year 1945, a total area of 20,000 acres was occupied by the wetlands. By the 1970's, the wetland areas were reduced to less than 10,000 acres. Considering the immense multifunctional values of the East Kolkata Wetlands, the Ramsar Bureau at the instance of the State Government and Government of India has declared the East Kolkata Wetlands as a "Ramsar Site" in November 2002. Now the East Kolkata Wetlands were designated a "Wetland of International Importance" under the Ramsar Convention on August 19, 2002.

Hundreds of rare flora, mammals, several species of birds, comprising both local and migratory types like grebe, coot, darter, shag, cormorant, teals, egrets, jacanas, snipes, tern, eagle, sand piper, gulls, rails and kingfishers, were regular visitors of these wetlands. But now a days these bird species are very rare. Previously the fish fauna in the East Kolkata Wetland system was composed of both brackish water and fresh water forms and now a days only fresh water fish species are recorded from these wetlands. Several other species of wetland plants may be extinct if the environmental condition is not to be properly maintained from the ecological point of view.

The environmental makeup of the city is of concern to all of us. But it is alarming to note that changes in the use of land have caused such diverse effects not only on the avian life but on other flora and faunal life of East Kolkata. So the loss or regression of diversity may be due to global warming and reclamation of parts of wetlands.

**Abstract: 11202**

### **MONITORING AND PREDICTING VEGETATION COVER CHANGE AT SPECIES LEVEL IN A CHANGING CLIMATE SCENARIO: A CASE STUDY OF THE SUNDARBANS**

**Md. Shafiul Alam, Manoj Kumer Ghosh and Chandan Roy**

Lecturer, Department of Geography and Environmental Studies  
University of Rajshahi -6205, Bangladesh  
E-mail: shafiul.geo@gmail.com

Sundarbans is the largest single mangrove tract in the world. This forest is unique because of its size and significance in balancing the local eco-system. Two-thirds of the Sundarban forest, that spread from the southern end of the Ganges Brahmaputra delta and stretches to the Hoogly River are in Bangladesh. Containing 37 species of mangrove plants Sundarbans represent the largest diversity of mangrove plants also. Sundarbans have declined 50-60 percent since 1960 mainly

due to a) increase in salinity b) erosion of the coastal region, c) top dying of main tree species, d) illegal intervention of human and e) unplanned use of forest resources in industrial sector. During the last years due to better implementation of regulations and proper monitoring illegal intervention of human and unplanned use of forest resources in industrial sector have been reduced remarkably but the observations using multi-temporal satellite image shows that species level change in vegetation is very prominent in Sundarbans. Increase in salinity, coastal erosion, inadequate fresh water flow from the upstream regions and change in rainfall pattern are mainly responsible for this delineation, which are directly or indirectly related to global climate change. Both the Governments of Bangladesh and India and other international organizations like UNESCO, FAO have taken different management plans to save this forest. But neither the Governments nor the international organizations are certain about the best suitable future management plan in a changing climatic situation. Vegetation cover prediction at species level taking salinity, rainfall pattern, upstream flow and coastal erosion into account can solve majority of this problem through bringing the future vegetation cover scenario before us. Markov model has been used successfully in land use and land cover change prediction with promising accuracy. The present research is an attempt to predict the future vegetation cover through analyzing the satellite image using Markov model. Landsat satellite images (of the year 1980, 1990, 2000 and 2010), rainfall, salinity and upstream flow information of the corresponding years were used as the input of the model. Then the model has been simulated to generate several future vegetation cover maps for several time intervals. Acceptable accuracy has been achieved through comparing short time simulated map and available vegetation cover map of the corresponding time.

**Abstract: 11141**

### **ALGAL SYMBIONTS INCREASE DNA DAMAGE IN CORAL PLANULAE EXPOSED TO SUNLIGHT**

**Badrun Nesa<sup>1,5</sup>, Andrew H Baird<sup>2</sup>, Saki Harii<sup>3</sup>, Irina Yakovleva<sup>4</sup> and Michio Hidaka<sup>1</sup>**

<sup>1</sup>Department of Chemistry, Biology and Marine Science, University of the Ryukyus, Okinawa 903-0213, Japan. <sup>2</sup>ARC Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, Queensland 4811, Australia. <sup>3</sup>Department of Earth and Planetary Science, The University of Tokyo, Hongo, Tokyo 113-0033, Japan. <sup>4</sup>A.V. Zhirmunsky Institute of Marine Biology, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok 690041, Russia,

<sup>5</sup>Binodpur Bazar, Rajshahi, Bangladesh

E-mail: tasrun@yahoo.com

This study investigated the effects of high PAR and UV on symbiotic and non-symbiotic planulae of the coral *Acropora tenuis*. Aposymbiotic planula larvae of *A. tenuis* were infected with homologous zooxanthellae. To test the hypothesis that algal symbionts make coral larvae

more susceptible to high photosynthetically active radiation (PAR) and ultraviolet radiation (UVR), symbiotic and non-symbiotic planulae of *Acropora tenuis* were exposed to natural sunlight (high PAR and UVR) at an ambient temperature of approximately 27°C for four days. DNA damage of the host cells was detected using a Comet Assay (single cell gel electrophoresis). Coral cells from symbiotic planulae had longer comet tails than those from non-symbiotic planulae, indicating that cells in symbiotic larvae had more DNA damage than those in non-symbiotic larvae. This result suggests that symbiotic algae are a source of oxidative stress in larvae under conditions at the ocean surface.

**Abstract: 11242**

### **IMPACT OF CLIMATE CHANGE ON ECOSYSTEMS**

**M. Mizanur Rahman<sup>1</sup>, Khairulmaini Osman Salleh<sup>1</sup> and AHM Zehadul Karim<sup>2</sup>**

<sup>1</sup>Department of Geography, University of Malay, <sup>2</sup>Department of Sociology & Anthropology, International Islamic University, Malaysia  
E-mail: mizanur@um.edu.my, khairulo@um.edu.my

An ecosystem is an interdependent, functioning system of plants, animals and microorganisms. Without the support of the other organisms within their own ecosystem, life forms would not survive, much less thrive. Such support requires that predators and prey, fire and water, food and shelter, clean air and open space remain in balance with each other and with the environment around them.

Climate is an integral part of ecosystems and organisms have adapted to their regional climate over time. Climate change is a factor that has the potential to alter ecosystems and the many resources and services they provide to each other and to society. Human societies depend on ecosystems for the natural, cultural, spiritual, recreational and aesthetic resources they provide. In various regions across the world, some high-altitude and high-latitude ecosystems have already been affected by changes in climate.

These changes can cause adverse or beneficial effects on species. For example, climate change could benefit certain plant or insect species by increasing their ranges. The resulting impacts on ecosystems and humans, however, could be positive or negative depending on whether these species were invasive (e.g., weeds or mosquitoes) or if they were valuable to humans (e.g., food crops or pollinating insects). The risk of extinction could increase for many species, especially those that are already endangered or at risk due to isolation by geography or human development, low population numbers, or a narrow temperature tolerance range.

The observations of this studies are to review the four major issues on climate change and its effects such as, geographical location, health impacts, greenhouse gas concentrations based on climate variability and finally to explore the IPCC report for its adaptation and mitigation for future environmental protection under climate policy.

**Abstract: 11098**

**ASSESSMENT OF CHANGES OF DRY SEASON FLOODPLAIN BEEL AREAS  
UNDER CLIMATE VARIABILITY FOR SUSTAINABLE AGRICULTURE AND  
FISHERIES RESOURCES MANAGEMENT USING GIS AND REMOTE SENSING  
TECHNIQUE**

**Motaleb Hossain Sarker<sup>1</sup>, Md. Sirajul Islam<sup>2</sup> and Hasibur Rahman<sup>2</sup>**

<sup>1</sup>GIS Division, CEGIS, <sup>2</sup>Dept. of ESRM, MBSTU, Tangail, Tangail, Bangladesh  
E-mail: mhsarker@cegisbd.com

Bangladesh is an agro based country and its economy depend on agriculture. More than 80% of people live in rural areas of Bangladesh. The major rice crop is grown in the dry season when the available surface water becomes less especially in floodplain beel areas. Due to climate change, Bangladesh has also been experiencing with different types of droughts in different seasons, which is highly disastrous for crop production and as well as for fisheries habitat restoration. Drought also impacted the dry season water availability and water demand for agriculture, fisheries, livestock and domestic purposes. Further, the marginal farmers and the subsistence fishermen are also directly dependent on the water availability (extent and depth) of this beel area.

In the above context, initiative was taken to assess the changes of dry season floodplain beel areas and impact on agriculture, fisheries and water resources using GIS and Remote Sensing Technique. GIS and RS is important planning tools to assess the changes detection of any natural resources and environmental issues efficiently. Thus, the intended study concerned with the identifying of dry season water availability in relation to climatic variability for sustainable agriculture and fisheries resources management in an integrated approaches using GIS & Remote Sensing. The study conducted at floodplain beel area (waterbodies) which is situated at the Chapai Nawabganj district of Bangladesh. The study area is under the Ganges basin and is hydrologically importance for agriculture and fisheries resources and the study area is under dry region of the country. The major problems in the study area are (i) during season the water availability in the beel is very less which is concern with habitat restoration/survival of fisheries, (ii) The farmer community usage surface water for irrigation of agricultural crops during dry season, (iii) The dry season extent of the beel is decreasing due to sedimentation, (iv) Aquatic biodiversity under threaten due to unavailability minimum water depth and volume. The main objective of the study was to assess the dry season water extent and depth (i.e. beel area and water availability) for sustainable agriculture and fisheries resources development. The major

activities of the study were (i) literature review (ii) reconnaissance field visit, (iii) data collection and collation, (iv) data analysis and GIS mapping (v) assessment of water extent/beel area, (vi) delineation of potential fish habitat zone and (vii) evaluation of study through report writing on study findings.

The study shows the remote sensing and GIS techniques are the very effective tools to identify the change detection of beel areas over the decades very efficiently for assessing the impact on bio-environment. The study shows that significant loss of wetland (more than 30%) has been occurred in the study area due to unplanned human activities and water abstraction, sedimentation and as well as climatic variability. The decreasing trend of water extent and variability of water extent has also been found from the study results which also indicate the there is good correlation with beel are with climate variability.

**Abstract: 11085**

**IMPROVING PRODUCTIVITY AND SUSTAINABILITY IN WARMER AREAS  
THROUGH RESOURCE CONSERVING TECHNOLOGIES: SAVE ENVIRONMENT  
AND REDUCE GLOBAL WARMING**

**M. Ilias Hossain<sup>1</sup>, M. H Ullah<sup>1</sup>, J. M Duxbury<sup>2</sup>, J. Lauren<sup>2</sup> and M. I. Hossain<sup>3</sup>**

<sup>1</sup>Regional Agricultural Research Station, BARI, Rahmatpur, Barisal, <sup>2</sup>Crops & Soil Science Department, Cornell University, USA and <sup>3</sup>Regional Wheat Research Centre, BARI, Rajshahi  
E-mail: iliasrwc@gmail.com

Rice-wheat (RW) cropping system produce green house gases through both biological process and burning of fuel by farm machineries. Every liter of diesel fuel used by tillage machinery and irrigation pumps contributes 2.6 kg CO<sub>2</sub> to the atmosphere. Thus, nearly 400 kg CO<sub>2</sub> would be generated per ha, assuming an annual use of 150 liters diesel in the conventional rice-wheat system. Specifically, reduce fossil fuel use leading to less greenhouse gas emission and slower global warming. Rice-wheat cropping systems are also critical to food security of increasing population in Bangladesh. However, the sustainability of RW systems is threatened by productivity decline and environmental sustainability. Crop production on permanent raised beds (PRB) with straw retention is expanding worldwide as a way to increase system productivity, diversify cropping and reduce global warming. When coupled with raised beds with straw retention can improve soil moisture retention, soil health, crop productivity and sustainability. A 3 years study was conducted at the Regional Wheat Research Centre, Rajshahi, Bangladesh as a warmer area, to compare the effects of under five N fertilizer levels (0, 50,100,150 and 200 % N of recommended dose) and two straw retention(SR)/tillage treatments (100% SR of all crops+ Permanent raised beds(PRB), 0% SR +PRB, 100% SR+ Conventional tillage practice (CTP) and

0% SR+ CTP in a intensified RW systems by adding a third pre-rice crop of mungbean. Permanent beds with straw retention produced the highest productivity for all three crops in the sequence. Within each N rate the total system (rice-wheat-mungbean) productivity was greatest with 100% SR on PRB and least in CTP with zero straw retention. At 100% of recommended fertilizer N rate, mean annual system productivity was 12.5 t/ha for PRB with 100% SR, 11.2 t/ha with PRB without SR and 10.3 t/ha with CTP without straw. System productivity in N unfertilized plots increased when straw was retained due to increased supply and uptake of N. The results suggest that N fertilizer rates can be reduced when straw is retained. Soil organic matter in surface soil layers of the PRB had increased by 0.22% after 3 years (3 rice-wheat-mungbean crop cycles) with straw retention, with a greater increase with 100% SR. Straw retention is an important component of crop sustainability and may have long term positive impacts on soil fertility. Water use efficiencies improved 25, 23 and 29% in wheat, rice, and mungbean crops, respectively when 100% SR with PRB system. By sowing crops on raised bed, irrigation water moves laterally from the furrow to the top and middle of the bed by capillary flow. Resource conserving technology required 103.8 l/ha fuel per year compared to conventional method 135 l/ha/year. 31.2 litre/ha/year fuel saved by resource conserving technology in rice-wheat-mungbean system. Compared with conventional tillage with all crop residues removed, the combination of PRB with residues retained appears to be a very promising technology for sustainable intensification of RW systems as well as reduces global warming in Bangladesh.

**Abstract: 11094**

## **CALL FOR WETLAND CONSERVATION AGAINST CHANGING CLIMATE**

**Sridevi, M., Ramachandran, A. and Malini, P.**

Centre for Climate Change and Adaptation Research, Anna University Chennai,

Sardar Patel Road, Chennai-600 025

E-mail: sridevi.cc@gmail.com

Over the course of history, ecosystems have always had to adapt to changing climatic conditions. The current rate of climate change, however, is higher than ever recorded. It is now obvious that humans have impacted biodiversity loss – directly through the destruction of habitats, and indirectly through climate change. It has been observed, hydrological changes could be the dominant effect of climate change, as snowmelt increases, as evaporation rates increase and as droughts, storms and floods intensify. Much of the hydrological changes will be reflected in changes in freshwater ecosystems including most of the wetland areas. Wetland ecosystems are especially vulnerable to climatic change. A changing climate may intensify these threats in many

ways, such as the spread of migration species, further fragmentation of species populations because of thermal constraints. As wetlands exist in the transition zone between aquatic and terrestrial ecosystem, they are vulnerable to changes in surface and ground water hydrology that are beyond the limits of adaptation and tolerance of wetland species. Moreover, changes to local biological diversity and species composition poses tremendous challenge to observation planning and implementation. This paper highlights the issues related to wetland functions, impacts of climate change on wetland biodiversity and conservation strategies for sustainable management in emerging scenario of climate change.

**Abstract:** 11203

## **PROTECTED VEGETABLE CULTIVATION TECHNOLOGY TO OFFSET CLIMATE CHANGE**

**J. C. Jana and R. K. Sarkar**

Department of Vegetable and Spice Crops, Faculty of Horticulture, Uttar Banga Krishi  
Viswavidyalaya, Pundibari, Cooch Behar, PIN- 736165, West Bengal, India  
E-mail: janajagadish@yahoo.co.in

Agriculture will face the deadliest experience from floods, droughts, tornadoes, cyclones, tidal surges, soil salinity, insect pests and disease incidences for climate change. Main focuses for adaptation to climate change will be the search for a new generation of crop varieties and crop management practices. Several abiotic stresses caused by extreme temperature, rainfall, humidity and radiation do not permit successful cultivation of all vegetables under open environment particularly during rainy season. Similarly, under open field conditions it is very difficult to grow vegetables successfully in the rainy season due to very high incidence of viruses, insect pests, fungal and bacterial diseases. But some low cost protected technologies like polythene shade just to protect rain water, insect proof net house, shade net house and zero energy naturally ventilated greenhouses are highly suitable for successful cultivation of common and high value vegetables throughout the year. Adaptations of crops with high nutraceutical value and varieties suitable for off-season cultivation, selection of crops according to market demand, crop rotation, intercropping, drip irrigation, mulching, lower planting densities, advance sowing dates, etc. made it high remunerative with expected cost benefit ratio from 1:2.0 to 1: 4.0. It made possible to grow green coriander during April to July, beet leaf during April to September, radish October to November, coloured capsicum during August to April, tomato during July to April, cherry tomato, lettuce, broccoli, leek, celery and parsley during September to March and parthenocarpic cucumber during August to April. Besides vegetable growing, raising quality vegetable seedlings under protected structures for very early crops in adverse weather condition

particularly for high cost hybrids give high return within a short period of time. Uses of different organic inputs in sufficient amount make the production system sustainable and increase price of the produce for better quality. Such protected cultivation is highly suitable and profitable in market vegetable gardening for peri-urban areas.

**Abstract:** 11211

### **A COMPOSITE PHOTOCATALYST FOR METHYLENE BLUE DEGRADATION UNDER VISIBLE LIGHT IRRADIATION**

**M. Maria Rahman, A. J. F. Samed, Mohammad Afsar Uddin,  
Ayesha Siddiqua and M. A. Hasnat**

Department of Chemistry, Graduate School of Physical Sciences, Shahajalal University of Science and Technology, Sylhet-3114, Bangladesh.

E-mail: mahtazim@yahoo.com, maht001@gmail.com, mah-che@sust.edu

The photocatalytic degradation of Methylene Blue (MB) under UV irradiation and even under ordinary visible light using a new composite photocatalyst  $Mn_{1-x}Cd_xS$  ( $x = 0.18$ ) has been introduced. The order of reactivity, irrelevant to the nature of light, followed the order of  $Mn_{1-x}Cd_xS$  ( $x = 0.18$ ) >  $TiO_2$  >  $ZnO$  >  $CdS$  at neutral pH. The lower band gap energy (2.1 eV) of the catalyst  $Mn_{1-x}Cd_xS$  ( $x = 0.18$ ) and dispersed nature of the photoinduced hole within the valence band, comprising the hybridized orbital of S and Cd valence shell orbital-rendering the prohibition of the recombination of the photo-induced electron and hole in the mechanistic path of direct photo-excitation of the catalyst- combined with the self-photosensitized degradation process of the dye molecules were identified as the reasons of the higher reactivity under visible light irradiation.

**Abstract:** 11060

### **SUSTAINABLE LIVELIHOOD IN INDIAN AGRICULTURE: THE SIMMERING CHALLENGE IN THE FACE OF GLOBAL WARMING AND CLIMATE CHANGE**

**M. M. Adhikary, S. K. Acharya and B. Biswas**

Department of Agricultural Extension, Bidhan Chandra Krishi Viswavidyalaya,  
Mohanpur, Nadia, West Bengal, India

Agriculture provides food, shelter, and cloths to the civilization and now it is going to be heinously hit by the simmering impact of global warming and climate change. Across the world every sensitive mind and sensible organizations are really concern what could be done to mitigate and defend and incoming danger and probably the incoming disaster. It has been found that one degree centigrade change in night temperature will invite a reduction in wheat and rice yields to the tune of thirty per cent and twelve per cent respectively. Out of 7800 kilometers of coastal lines of India, thirty per cent may be submerged by the up surging sea levels by 2050 to

create a drifting effect of population, occupation, and social balances too. Nevertheless the change of cropping pattern, mutant behavior of crops, erosion of crop bio-diversity, dramatic changes in behaviour of critical growth stages of crops and all have already been distinctively observable here in this part of World. The present paper examines the sustainable livelihood issues in terms of changing wage pattern, food intake value, health status and livelihood security of farming populates in the villages of West Bengal, India. These all chaotic changes in the erstwhile balances of livelihood generating system is certain to make the issues of global warming more complex. It has been found that even the consequences of livelihood security and food intake value are being impacted conspicuously by factors like cropping intensity and crop spacing. The study further reveals that the variables like holding size and crop spacing have recorded significant regression impacts on the predicted variable like food intake value. The study was conducted in a classically changing village, Goragachha by name, over eighty respondents, mainly small and marginal farmers. Statistical tools like multistage regression analysis and path coefficient have been applied to isolate the discernable factors and also to delineate the interactive reticulate impact of some exogenous variables on the consequent character like sustainable livelihood system. As a method altogether fifteen predictor variables have been selected in this study to assess their interactive impacts of predicted character like livelihood security (Y1), food intake value (Y2), health status (Y3), wage (Y4) and sustainable livelihood (Y5). In a country like India where more than eighty percent populace are eking out their livelihood from a size of holding less than two hectares per capita, the impact of climate change on livelihood security is going to be the worst and most prominent too. So, the modeling of livelihood system as being managed in rural India has so far been the most urgent issue and responsibility to combat the deleterious impact of climate change.

**Abstract: 11059**

### **CLIMATE CHANGE IMPACT IN THE POPULATION OF LADY BIRD BEETLE ON VEGETABLE CROPS AND HARMFUL EFFECT OF INSECTICIDES**

**Sunil Kr. Ghosh, and G. Chakraborty**

Department of Agricultural Entomology, Uttar Banga Krishi Viswavidyalaya (University),  
Pundibari, Cooch Behar, West Bengal-736165, India  
E-mail: sunil\_ent69@yahoo.in

Various predators, parasitoides and pathogens cause natural suppression of insect pests of different vegetable crops particularly brinjal, tomato, chilli, ladyfinger etc. Among the different predators lady bird beetles play an important roll in the natural suppression of destructive insect pests viz., jassid, aphid, thrips, mites and eggs of many other insect pests. *Coccinella sp.*, an important lady bird beetle in the sub-Himalayan region of north-east India (terai region of West Bengal) was found very active on different insect pests of brinjal throughout the year. The level

of population varied from year to year depending on their host and prevailing weather conditions. Analysis of pooled data for the years, 2004 and 2005 revealed that initially its population was recorded higher during March-April and then declined. Highest average population (4.87 *Coccinella*/plant) was recorded during March (11<sup>th</sup> standard week) when the mean temperature, mean relative humidity and weekly rainfall were 23.8°C, 74.2 % and 8.2 mm respectively. *Coccinella* incidence showed significant positive correlation ( $p= 0.05$ ) with maximum temperature and significant negative correlation with maximum, minimum and mean relative humidity whereas with minimum and mean temperature and rainfall the correlation was negative but non-significant. The population of *Coccinella* was found throughout the growing period of ladyfinger feeding on destructive pests. In the kharif season, 2005 population was found higher (3.5/plant) during 3<sup>rd</sup> and 4<sup>th</sup> week of July in active vegetative growth of the crop. In early stage of crop growth different insect pests on vegetable crops can be controlled with protective synthetic insecticides but cause harmful effect to the bio-agents. The control of pests through synthetic pesticides is rather difficult as there is possibility to retain toxic residues in the fresh cut vegetables which cause health hazard and environmental pollution. From field evaluation of insecticides on brinjal it was revealed that insecticides of biological origin were relatively less harmful to *Coccinella* than synthetic ones. The pathogens, *Bacillus thuringiensis* Berliner and *Beauveria bassiana*(Bals.) Vuillemin caused significant lower killing of the predator (less than 40 %) whereas the synthetic insecticides, DDVP and malathion caused significantly higher killing (more than 50 %). Botanical and microbial insecticides are biopesticides having less or no hazardous effects on bio-agents, human health and the environment, and therefore, they can be incorporated in IPM programmes and organic farming.

**Abstract: 11111**

### **STUDIES ON SEED PRIMING, ROW SPACING AND FOLIAR NUTRITION IN CHICKPEA UNDER RAINFED CONDITIONS IN WEST BENGAL, INDIA**

**M. K. Bhowmick<sup>1</sup>, P. K. Biswas<sup>2</sup>, P. Sen<sup>3</sup> and P. Bhattacharyya<sup>4</sup>**

<sup>1</sup>Rice Research Station (Government. of West Bengal), Chinsurah (R.S.)-712 102, Hooghly, West Bengal, India, <sup>2</sup>Institute of Agriculture (Palli Siksha Bhavana), Visva-Bharati, Sriniketan-731 236, Birbhum, West Bengal, India, <sup>3,4</sup>Directorate of Agriculture (Government of West Bengal), Writers' Buildings, Kolkata-700001, West Bengal, India  
E-mail: bhowmick\_malay@rediffmail.com; drpradipsen@yahoo.com, ppabitra07@rediffmail.com

Chickpea (*Cicer arietinum* L.) is an important cool season food legume that generally attains poor growth under rainfed conditions, resulting in poor grain yields. Seed priming is a simple technique which may help in improving plant stand, plant vigour and grain yield particularly under such conditions. Basal fertilization in many cases does not seem to be effective,

particularly due to lack of soil moisture in the root zone. As most of the root nodules degenerate at the time of flowering and the crop demand for nutrients is quite high at reproductive phase, the spray application of fertilizers may be effective to improve reproductive growth and development of the crop.

Keeping the above background in view, a field experiment was conducted during *rabi*, 2004-05 at the Pulses and Oilseeds Research Sub-station, Beldanga, Murshidabad, West Bengal, located at 23°55'N latitude and 88°15'E longitude with an altitude of 19.0 m AMSL in the North Eastern Plain Zone (NEPZ) of India. Twelve treatment combinations comprising of two levels of seed priming *viz.* no seed soaking and seed soaking in water (8 hours), two different row spacings *viz.* 30 cm and 45 cm, and three levels of foliar nutrition *viz.* water spray, urea spray (2% solution) and KCl spray (3% solution) were tested in factorial randomized block design with four replications. The crop variety Mahamaya 1 (B 108) was sown at a seed rate of 50-60 kg ha<sup>-1</sup>, depending upon row spacing of 30-45 cm, on November 24, 2004 and harvested on April 07, 2005. Other recommended management practices were followed to raise the crop. Foliar sprays were given twice at the reproductive phase i.e. one at flower initiation and the other at 10 days after the first spray. There was a total rainfall of about 81.8 mm as received in 11 numbers of effective rainy days during the crop growth period when the maximum and minimum temperatures were 33.8°C and 11.4°C, respectively. Plant heights were recorded at 70 days after sowing and also at the time of crop harvest. Grain yields along with yield attributes were recorded at harvest.

Seed priming (1128.63 kg ha<sup>-1</sup>) produced significantly higher grain yields over the use of non-primed seeds (848.29 kg ha<sup>-1</sup>) whereas a row spacing of 30 cm (1210.21 kg ha<sup>-1</sup>) significantly out yielded that sown at 45 cm (766.71 kg ha<sup>-1</sup>). Foliar spray of 2% urea solution was also found superior to either 3% KCl or simple water spray in respect of both the growth and yield attributes along with grain yields. Yield increments due to urea spray (1136.38 kg ha<sup>-1</sup>) were 17.21 and 32.22% over KCl spray (969.56 kg ha<sup>-1</sup>) and water spray (859.44 kg ha<sup>-1</sup>), respectively.

From the above findings, it might be inferred that sowing of primed seeds at a row spacing of 30 cm followed by proper management practices including two rounds of foliar sprays with 2% urea solution (the first at flower initiation and the second at 10 days after the first one) would be an effective recommendation for improving crop growth and yield of rainfed chickpea in the NEPZ of the country.

**Abstract: 11112**

**EFFECT OF BASAL FERTILIZATION AND FOLIAR NUTRITION ON GROWTH, NODULATION AND SEED YIELD OF LENTIL (*LENS CULINARIS* MEDIKUS) IN WEST BENGAL, INDIA**

**P. K. Biswas<sup>1</sup>, M. K. Bhowmick<sup>2</sup>, P. Sen<sup>3</sup> P. Bhattacharyya<sup>4</sup> and G. C. Malik<sup>5</sup>**

<sup>1,5</sup>Institute of Agriculture (Palli Siksha Bhavana), Visva-Bharati, Sriniketan-731 236, Birbhum, West Bengal, India, <sup>2</sup>Rice Research Station (Government. of West Bengal), Chinsurah (R.S.)-712102, Hooghly, West Bengal, India, <sup>3,4</sup>Directorate of Agriculture (Government of West Bengal), Writers' Buildings, Kolkata - 700001, West Bengal, India  
E-mail: ppabitra07@rediffmail.com, drpradipsen@yahoo.com, ganeshmalik\_2004@rediffmail.com, bhowmick\_malay@rediffmail.com

Lentil (*Lens culinaris* Medikus) is an important food legume grown under marginal lands by resource poor farmers. Foliar nutrition may be a fruitful device particularly for the areas where basal fertilization often leads to locking or loss of nutrients. With this technique, nutrients can reach to the site of food synthesis directly, leaving no wastage and thereby the requirement of fertilizer may be cut short from a huge bulk to a handful. But foliar nutrition is supplementary to and cannot replace the basal fertilization. Being grown mainly on the soils poor in fertility, an adequate and balanced fertilization is necessary to realize good yields. Nutrient management is, therefore, an important aspect in lentil.

Keeping the above background in view, a two-year field study was conducted during *rabi*, 2004-05 and 2005-06 at the Pulses and Oilseeds Research Sub-station, Beldanga, Murshidabad, West Bengal, located at 23°55'N latitude and 88°15'E longitude with an altitude of 19.0 m AMSL in the North Eastern Plain Zone (NEPZ) of India. Altogether 14 treatment combinations, keeping two levels of basal fertilization (no dose and recommended dose of N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O at 20-40-20 kg ha<sup>-1</sup>) in main plots and seven levels of foliar spray (no spray, water spray, 2% DAP spray, NH<sub>4</sub>OH spray, 0.8% urea spray, NH<sub>4</sub>OH + H<sub>3</sub>PO<sub>4</sub> spray and 1.5% urea spray) in sub-plots were tested in split-plot design with three replications.. The concentration of NH<sub>4</sub>OH and H<sub>3</sub>PO<sub>4</sub> was adjusted to match with the content of N and P<sub>2</sub>O<sub>5</sub> in 2% DAP solution. Basicity and acidity of the solution was compensated with additional dilution. The crop variety Subrata (WBL 58) was sown at a spacing of 25 cm x 10 cm using a seed rate of 30 kg ha<sup>-1</sup> on October 30, 2004 and November 11, 2005 during 2004-05 and 2005-06, respectively. Foliar sprays were given at 40 days after sowing (DAS). Harvesting was done on March 10, 2005 and 17, 2006 during 2004-05 and 2005-06, respectively. Observations on plant height, dry matter accumulation, nodulation, seed yield and yield attributes were recorded.

The results revealed that foliar spray of either 1.5% urea or 2% DAP solution at 40 DAS could remarkably increase crop growth, nodulation and seed yield in lentil. Again, the treatment 0.8% urea spray (1109.50 kg ha<sup>-1</sup>) was found at par with the 2% DAP spray (1097.50 kg ha<sup>-1</sup>) in increasing seed yields. Yield increments due to spray of 1.5% urea, 0.8% urea and 2% DAP solution were 17.82, 13.27 and 12.05% over absolute control (no spray), respectively. A basal dose of N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O at 20-40-20 kg ha<sup>-1</sup> (1261 kg ha<sup>-1</sup>) was also found superior to no application (1049 kg ha<sup>-1</sup>) in influencing seed yield.

A perusal of the trial results, thus, showed that addition of N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O at 20-40-20 kg ha<sup>-1</sup> at land preparation along with foliar spray of either urea (0.8-1.5% solution) or DAP (2% solution) at 40 DAS would be an effective recommendation for improving crop growth, nodulation and seed yield of lentil in the NEPZ of the country.

**Abstract: 11128**

### **CLIMATE CHANGE AND SALINITY IN BANGLADESH: CONSTRAINTS AND MANAGEMENT STRATEGY FOR CROP PRODUCTION**

M.S. Uddin, M.S. I. Khan, M.M.R. Talukdar, M. I. Hossain and M.H. Ullah  
Regional Agricultural Research Station,  
Bangladesh Agricultural Research Institute Rahmatpur, Barisal-8211  
E-mail: mdsaleh03@yahoo.com

Climate change is an important issue now-a-days. Global warming i.e. climate change causes sea level rise and that affect the coastal areas of Bangladesh. Bangladesh is a deltaic country with total area of 147,570 km<sup>2</sup>. The major part (80%) of the country consists of alluvial sediments deposited by the rivers Ganges, Brahmaputra, Tista, Jamuna, Meghna and their tributaries. Terraces with an altitude of 20-30 m cover about 8% of the country, while hilly areas with an altitude of 10-1000 m occur in the southeastern and northeastern part. The coastal region covers almost 29,000 km<sup>2</sup> or about 20% of the country. Again, the coastal areas of Bangladesh cover more than 30% of the cultivable lands of the country. About 53% of the coastal areas are affected by salinity. Agricultural land use in these areas is very poor, which is much lower than country's average cropping intensity. Salinity causes unfavorable environment and hydrological situation that restrict the normal crop production throughout the year. The dominant crop grown in the saline areas is local transplanted Aman rice crop with low yields. The cropping patterns followed in the coastal areas are mainly Fallow-Fallow-Transplanted Aman rice. Salinity problem received very little attention in the past. It has become imperative to explore the possibilities of increasing potential of these (saline) lands for increased production of crops. Thus combating

land salinization problem is vital for food security in the country through adoption of land and crop management strategy.

**Abstract: 11234**

**HAS ERYTHRINA GALL WASP (*QUADRSTICHUS ERYTHRINAE* KIM.) BECOME INVASIVE TO NON-NATIVE REGIONS IN RESPONSE TO RECENT CLIMATE CHANGE? - A REVIEW**

**B. K. Das and B. Talukdar**

Department of Agricultural Entomology, Faculty of Agriculture, Bidhan Chandra Krishi Viswavidyalaya (State Agricultural University), Mohanpur-741252, Nadia, West Bengal, India  
E-mail: bkdas1963@rediffmail.com

Several species of Eulophidae (Insecta: Hymenoptera) are known to induce plant galls (La Salle, 2005) and are specialist in resource use. There is a growing list of eulophid gall inducers which have become invasive in different non-native countries within the last two decades. The exact cause behind their being invasive is not known. The erythrina gall wasp (EGW), *Quadrastichus erythrinae* Kim (Hymenoptera: Eulophidae: Tetrastichinae) is one of them. It was first noticed in 2000 inducing galls on coral trees, *Erythrina* sp. (Fabaceae) in La Réunion and described as new species by Kim et al., in 2004. It has proved itself as the most aggressive, swiftly invasive and destructive arthropod pest to sweep across the countries in Indo- Australasian, Afrotropical and Nearctic regions in last ten years, posing imminent threat to native *Erythrina* species in different countries. It is now known that *Q. erythrinae* naturally occurs in East Africa (Tanzania) and a group of *Quadrastichus* species induce galls on *Erythrina* in Africa where they have a complex of natural enemies. At the same time, it is also known that the *Q. erythrinae* populations from the newly invaded countries is different from that in Africa in some behavioural traits.

The discovery of new invasive EGW in different countries raises several questions regarding its nature, origin and also pathways of introduction to new area. Its enormous expansion rate and invasive ranges covering many disjunctive countries separated by large water bodies indicate that the wasp is dispersing on its own or through natural agencies by long distance flight. But the question remains unanswered- why it had not spread before to invade non-native hospitable zones?

Insects are sensitive to extreme weather (droughts, heat waves, cold spells). As a result of climate change and deforestation, tropical environments could very well become too hot, dry or fragmented for many insect species to persist (Williams, Bolitho and Fox, 2003). Moreover, species that exhibit highly evolved host plant interactions (as in the present case) or inhabit

microhabitats are at high risk of extinction, especially in tropical areas (Lewis, 2006). Global warming is affecting the distribution of insects around the world with a pole-ward trend (Parmesan et al., 1999; Thomas et al., 2001); but the change is gradual, not abrupt and expansion is generally conjunctive. Organisms must respond to the changing conditions to survive by phenotypic plasticity in thermal responses or by changes in the genetic composition of populations (Pulido & Berthold, 2004).

Genetic change is a natural process and insects can rapidly change their genetic make up in response to climate change. It was found that individuals colonizing unoccupied habitats typically possess characters associated with increased dispersal (in insects it is flight morphology) (Hill et al., 1999).

Did any change in genetic make up occur in migrating population of specialist EGW in Africa for which the driving force been the recent changing climate? If so, resultant biotype might have acquired the dispersal characters like durability and morphology favouring long distance migration to avoid extinction. The other recent invasive gall inducers most likely changed themselves. Recent studies suggest that invasion and evolution are closely related (Champagnat & Méléard, 2007).

**Abstract: 11121**

**EFFECT OF DIRECT AND DERIVED TEMPERATURE VARIABLES ON ANTHOCYANIN CONTENT OF AFRICAN MARIGOLD (*TAGETES ERECTA* LINN.) CV. SIRACOL**

**P. Pal, A. Mandal (Khan), P. Ghosh and A. Saha**

\* Department of Floriculture and Landscaping, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur- 741252, Nadia, West Bengal, India  
E-mail: pal\_pranabananda@yahoo.co.in

The investigation was conducted to understand the role of different climatic parameters enjoyed by African marigold (*Tagetes erecta*) cv. Siracol at different phenological stages on the anthocyanin content of flowers. This cultivar produces orange red colour flowers mostly throughout the year. Maximum and minimum temperature and daily sunshine hours enjoyed by the crop during P (planting) - FBI (flower bud initiation), FBI-CS (colour shown), CS-FB (full bloom), P-CS, P-FB and FBI-FB stages were utilized to derive different thermal indices to find out the relationship between anthocyanin content and climatic condition. Correlation studies showed that anthocyanin content was more sensitive to weather parameters prevailing during reproductive stage specially FBI-CS than during vegetative stage (P-FBI), indicating thereby weather sensitiveness of this particular phenological stage for the synthesis of pigment. During

reproductive stage accumulated diurnal variation of temperature showed better correlation with anthocyanin content than mean temperature.

Temperature variables, corresponding to reproductive stage of marigold, could individually explain 64-85% variability of anthocyanin content at harvest. Accumulated diurnal variation during FBI-FB could alone explain 85% variability of the anthocyanin content. Hence, the linear regression equation using this variable can be used to quantify / predict anthocyanin content of marigold on the basis of weather variables, minimum and maximum temperature, during this phenological stage well ahead of harvest, assessing its worthiness in the market and processing industry.

## Poster Presentations

**Abstract: 11062**

## **FRUIT CULTIVATION OF WEST BENGAL, INDIA IN CHANGING CLIMATE SCENARIO**

**Nilesh Bhowmick<sup>1</sup>, S. K. Ghosh<sup>1</sup>, C. P. Suresh<sup>1</sup>, P. K. Paul<sup>1</sup>, P. Deb\***

<sup>1</sup>Dept of Pomology and Post Harvest Technology, Uttar Banga Krishi Viswavidyalaya,  
PO- Pundibari, Dist- Cooch Behar, West Bengal, India, Pin 736165,

\*National Research Centre for Orchids, Sikkim, India

E-mail: Nileshbhowmick@gmail.com

With the advancement of modern civilization, directly and indirectly there is a great pressure on our earth. As a result of pollution, global warming we are facing adverse weather condition for a last few decades. And, now it is the time for observing its feeling on our crop cultivation. Fruit crops are not exception from the invasion of changing climate scenario. In West Bengal the major fruit crops are mango, banana, pineapple, guava, litchi, papaya, lime, lemon, sapota are cultivated in commercial orchards and many minor fruits like jackfruit, jamun, karonda, ber are grown. Mostly they are facing problem regarding its flowering and aggravation of physiological disorders. Erratic flowering and increasing the intensity of physiological disorders like spongy tissue and black tip are observed in mango. The incidence of black tip disorder is more in Malda district due to high activity of brick kiln industry. Prolong summer and very hot blowing wind, particularly in southern districts of West Bengal and due to the pierced ozone layer causes more emission of UV light which causes the more intensity of lumpiness of banana and it is more prevalent in cv. Martaman. Litchi is grown as essentially subtropical fruit crop and it requires lower temperature, at or below 15°C for 2 months before flowering for inducing good flower. Due to changing climate scenario, very often, this type of requirement may not be achieved by litchi, resulting less or erratic flowering. Again during fruit growth and development period which coincides with the summer months, often it has been experienced with very less, erratic rainfall causing hampering of proper fruit development. It also increases the incidence of fruit cracking due to increasing of fruit skin inelasticity. West Bengal is the leader of pineapple producer in India. The occurrence of mealy bug infestation and *Fusarium* wilt is more prevalent in the northern parts of West Bengal, most probably due to changing climate scenario. Latka, panial, jalpai are three important minor underutilized fruit crops, specially for northern districts of West Bengal and they are facing existence problem or their occurrence is reducing day to day. They may be losing their capacity for adaptation in changing climatic scenario. One of the major problems in this area of research is till date there is very less published report or data regarding the effect of climate change.

**Abstract: 11068**

**LIVELIHOOD PATTERN AND ADAPTATION STRATEGIES OF CHAR PEOPLE: A  
CASE STUDY OF KAOAKOLA UNION OF SIRAJGONJ DISTRICT**

**K. M. Rezaul Karim**

Department of Sociology, Government B. L. University College, Khulna-9202, Bangladsh  
E-mail: rezakarim.km@gmail.com

The life pattern of char people is some extent different from the people of mainland. The inhabitants of the char are among the most hazard-prone people of Bangladesh, exposed as they are to floods and erosion. Erosion, accretion and flooding are major factors in the lives of the char people. Such events are the main reason for the temporary nature of the char settlement. They have to struggle against nature constantly. They are backward from the socio-economic, political and cultural point of view. The occupation of them is mainly agriculture, fishing, small business, day labour etc. It is known that about 80% of them involved in agriculture directly or indirectly. Despite extreme poverty, fragile socio-economic condition and lack of proper support from Government as well as NGOs, these people coped well with the natural disasters by means of the indigenous knowledge passed on to them generation to generation. This paper is an attempt to analyse and describe the livelihood pattern and adaptation strategies of the char people.

**Abstract: 11076**

**EARTHWORMS THE RESOURCES OF NATURAL MEDICINE:  
A CLINICAL STUDY ON RHEUMATIC FEVER PATIENTS**

**Md. Sarwar Jahan, Md. Mijanur Rahman and Md. Redwanur Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi, Bangladesh  
E-mail: redwan\_rahman@lycos.com

Earthworms had been used as the potential source of medicine for treatment of many diseases related to rheumatic fever effectively from ancient time. Accordingly, it was thought that earthworm tissue might contain certain effective medicinal compounds to cure rheumatic fever and investigations were performed in laboratory test and clinically. First of all earthworm's extract was obtained from dry powder of one of the most common indigenous species by using successively ten different solvents through continuous hot percolation process for extraction. Diethyl ether, chloroform, methanol, ethanol, propanol, butanol, acetic acid, acetone, xylol and morpholine extracted out  $2.89 \pm 1.23$ ,  $3.32 \pm 1.36$ ,  $16.25 \pm 3.15$ ,  $4.62 \pm 1.73$ ,  $0.86 \pm 0.29$ ,  $0.93 \pm 0.36$ ,  $1.15 \pm 0.49$ ,  $1.09 \pm 0.46$ ,  $0.76 \pm 0.38$ , and  $0.80 \pm 0.18$  in percent by weight (mg) of the dry powder of earthworm tissue.

As the extraction was achieved to test the medicinal efficacy of earthworm extract it was obligatory to test the toxicity of the compounds. Toxicity test on guineapig (*Cavia porcellus*) showed that earthworm extracts obtained had no toxic or adverse effect.

Diethyl ether, chloroform, methanol, ethanol, propanol, butanol, acetic acid, acetone, xylol and morpholine extracts inhibited  $12.50\pm 2.20\text{mm}$ ,  $12.86\pm 3.72\text{mm}$ ,  $14.60\pm 4.00\text{mm}$ ,  $14.93\pm 2.74\text{mm}$ ,  $1.50\pm 0.77\text{mm}$ ,  $8.13\pm 2.65\text{mm}$ ,  $14.70\pm 3.12\text{mm}$ ,  $2.20\pm 1.12\text{mm}$ ,  $1.46\pm 0.50\text{mm}$  and  $1.60\pm 0.67\text{mm}$  respectively when applied on  *$\beta$ -haemolytica streptococcus* culture *in vitro*.

Primarily each of the ten crude extractives was orally administrated on five rheumatic fever patients for six weeks to test their medicinal efficacy. This study was found that only methanolic and ethanolic extracts were able to play vital role in curing the patients and the rest did not response positively.

Later on the effective *i.e.* methanolic and ethanolic ones were applied on rheumatic fever patients along with a control group treated with placebo. For each treatment 20 patients were considered in course of the study. Methanolic and ethanolic extracts cure 55% and 70% patients respectively. This study shows that the earthworm tissue may be used as a source of an effective (natural medicine) biomedicine for treatment of rheumatic fever.

**Abstract: 11077**

### **BIOCHEMICAL ANALYSIS OF EARTHWORM TISSUES: AN INITIAL ATTEMPT IN SEARCHING NATURAL REMEDY FOR RHEUMATIC FEVER**

**Md. Sarwar Jahan, Md. Mijanur Rahman and Md. Redwanur Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi, Bangladesh  
E-mail: redwan\_rahman@lycos.com

The experiment was conducted with a view to detect effective and safe medicinal compounds for management of rheumatic fever from tissues of only adult individuals of an indigenous earthworm species. The study was consequence of an initial attempt in searching natural remedy for a very obnoxious diseases and rheumatic fever.

Uninfected adult individuals of one of the abundant indigenous species of earthworms were collected from garbage, compost pit, house hold drainage where organic matter and moister were sufficient by applying digging and hand sorting methods from Rajshahi University campus and different areas of Rajshahi City Corporation for extraction and biochemical analysis. Earthworms were washed tape water and kept in a deep Freezer for killing after drying this sample was used for extraction.

First of all earthworm's extract was obtained from dry powder by using successively ten different solvents like diethyl ether, chloroform, methanol, ethanol, propanol, butanol, acetic acid, acetone, xylol and morpholine through continuous hot percolation process for extraction. All extractive were about to  $32.64 \pm 4.75$  gm in percent by weight (gm) of the dry powder of earthworm tissue. Biochemical analysis disclosed that the total extract ( $32.64 \pm 4.75\%$ ) contained  $59.52 \pm 9.96\%$  crude protein,  $4.82 \pm 1.36\%$  crude fat,  $4.67 \pm 2.10\%$  crude carbohydrate,  $5.65 \pm 2.38\%$  total ash,  $2.54 \pm 0.99\%$  crude fibre and  $0.048 \pm 0.018\%$  steroids. TLC and PTLC revealed that 100 mg of earthworm protein contained seven essential amino acids, cysteine ( $1.64 \pm 0.72$  mg), histidine ( $3.23 \pm 1.00$ mg), lysine ( $6.55 \pm 1.09$ mg), methionine ( $2.40 \pm 0.60$ mg), phenylalanine ( $5.25 \pm 1.01$ mg), tryptophan ( $2.11 \pm 0.55$ mg) and valine ( $4.22 \pm 1.02$ mg).

For the calculation of protein clear supernatant sample were applied in micro-Kjeldahl's distillation unit. On the average most proteins contain 16% nitrogen in their composition. In other words, 1mg nitrogen equals 6.25gm protein i.e. amount of protein = estimated amount of nitrogen  $\times 6.25$ .

Biochemical analysis for determining earthworms' tissue contents were carried out using the mixture of all the extracts obtained by applying considered solvents successively. It might be so happen that analyses of individual samples separately may result variedly. Again, only one pair of test animals was considered for extracts obtained by each solvent to determine the toxicity.

**Abstract: 11086**

## HYDROCHEMISTRY OF GROUND WATER IN RAJSHAHI CITY, BANGLADESH

**S. M. Helal Uddin, M. G. Mostafa and A. B. M. H. Haque\***

Institute of Environmental Science, University of Rajshahi; \*Department of Chemistry,  
University of Rajshahi, Rajshahi-6205, Bangladesh  
E-mail: helaluddin\_ies07@yahoo.com

Climate change will have significant impacts on water resources as there is very close connection between the climate and hydrological cycle. Rising in temperatures will increase evaporation and lead to increases precipitations, frequent and extreme floods and droughts in different regions and different times. Groundwater is the single largest source of potable water supply in Bangladesh. Groundwater is vulnerable to contamination from many sources. It has, therefore, become imperative to aim at assessing the physical and chemical quality and water type of the

groundwater to ascertain their wholesomeness as well as the health impacts of the groundwater in Rajshahi city.

The study area, Rajshahi city is a major urban growth center of the Northwestern region of Bangladesh and located on the bank of the Padma River. A total of 120 water samples were collected in 2008-2009 from 30 locations including shallow and deep tube wells in the city for physico-chemical analysis covering pre and post-monsoon seasons in two years. The samples were analyzed to determine the physical parameters and major anions and cations. The results of analyses show that water was slightly alkaline to neutral pH and moderately high to high mineralized with conductivity ranging from of 460  $\mu\text{S}/\text{cm}$  to 895  $\mu\text{S}/\text{cm}$ . Degree of hardness was very hard due to  $\text{HCO}_3^-$  and  $\text{SO}_4^{2-}$  of Ca, Mg although Mg concentration remains below the WHO limit. It is observed that about 100%, 53.33%, 100%, 14% and 14% of ground water samples exceed the permissible limit of  $\text{HCO}_3^-$ , Ca, Fe,  $\text{SO}_4^{2-}$  and Cu respectively prescribed by WHO. The chemical data indicate that around 60% and 25 % of the total groundwater samples exceed Pb and As safe limits. Exposure to high concentrations of As and Pb over the course of years have been associated harmful effect on human health. Na, K, Mg, Zn, Cd,  $\text{CO}_3^{2-}$ ,  $\text{Cl}^-$  and  $\text{NO}_3^-$  are within the permissible limits prescribed. The mean concentration of other major cations such as Fe, Zn, Cu and Pb were 0.16, 0.133, 0.125, 3.4 mg/L, respectively. The dominant anionic ion was  $\text{HCO}_3^-$  and its concentration was 1616.50 mg/L. The mean concentration of other anions such as  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$  were 62.70, 32.05, 3.13 mg/L, respectively. The overall hydrochemistry reveals that the order of cation abundance is  $\text{Ca} > \text{Mg} > \text{Fe} > \text{Pb}$  and in anionic chemistry, the order is  $\text{HCO}_3^- > \text{Cl}^- > \text{SO}_4^{2-} > \text{NO}_3^-$ .

The study reveals that the water type was Ca- $\text{HCO}_3$ . The  $\text{HCO}_3^- / (\text{HCO}_3^- + \text{SO}_4^{2-})$  ratio (0.98) indicates that mostly carbonic acid weathering process due to presence of calcium carbonate mixed with clay/fine sand. Overall results showed that groundwater quality are not suitable for drinking purpose. The study concluded that groundwater quality is impaired by anthropogenic activities and proper management plan is necessary to protect valuable groundwater resources in Rajshahi city, Bangladesh. But, it is not easy to understand the impacts of Climate change on water quality. However, it is suggested that both the water quality and quantity may be affected due to the impacts of climate change as the hydrological cycle is closely related to the climate. Climate change could also increase in demand for domestic and irrigation water supply.

**Abstract: 11087**

### **THE POTENTIALITY OF *TRICHODERMA* STRAINS FOR BIOCONVERSION OF MUNICIPAL SOLID ORGANIC WASTE**

**M. A. Islam, M. G. Mostafa and M. R. Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi-6205, Bangladesh  
E-mail: islamies@yahoo.com

In Bangladesh, every day huge quantities of domestic or kitchen or municipal organic waste were generated. This type of waste is causing adverse effect on living organisms, environment and over all the natural ecosystem. Composting is a bioconversion process of an organic waste substrate into stable organic end products (compost). These end products have tremendous impact on nutritional value for plant growth and development by conserving soil fertility. This study was conducted to see the potentialities of *Trichoderma spp.* for solid waste bioconversion into compost and its effects on the growth of different vegetables. In this study five *Trichoderma* strains were considered, of them three species were used for *in vitro* and *in vivo* bioconversion process. The strains were *Trichoderma virens* (IES-101), *Trichoderma pseudokonongii* (IES-102), *Trichoderma harzianum* (IES-103), *Trichoderma harzianum* (IES-104) and *Trichoderma harzianum* (IES-105). The effect of different concentration of glucose and pH values with PA (Potato Ager) medium on mycelial growth of *Trichoderma* have been studied. To select the most effective strain on bioconversion of municipal solid waste autoclaved and non autoclaved process were used. The highest (91mm) mycelial growth of *Trichoderma harzianum* (IES-103) was found in 1.5% concentration of glucose at 5.0 pH. *In vitro* conversion of solid organic waste, the highest height losses were found 0.5 cm, 1.3 cm and 1.9 cm after 10, 20 and 30 days and the highest weight losses were found 14.98 %, 23.86 % and 31.80 % after 10, 20 and 30 days respectively. *In vivo* conversion of solid organic waste, the highest height losses were found 7.8 cm, 17.4 cm and 23.6 cm after 10, 20 and 30 days and the highest weight losses were found 18.62 %, 26.82 % and 39.80 % after 10, 20 and 30 days respectively. The field trials of the compost obtained from the same fungal strain was found the most effective for the growth of some vegetables. The highest plant height *Amaranthus lividus* (lal shak) 74 cm after 36 days and *Basella alba* (pui shak) 1.36 meter after 45 days were obtained. In this study the result showed that *Trichoderma harzianum* (IES-103) is the most effective strain on the basis of height reduction and weight loss (%) for degradation of solid waste. Field trials results also show that the compost obtained for the same strain (*Trichoderma harzianum*) was the most effective for the growth of some vegetables.

**Abstract: 11089**

## **CAUSES AND EFFECTS OF LAND USE CHANGES IN THE COASTAL AREAS IN BANGLADESH: A MAN-MADE DISASTER**

**Asib Ahmed and Md. Abu Hassan Faruk**

Department of Geography and Environment, University of Dhaka, Dhaka-1000, Bangladesh  
E-mail: asib01geo@gmail.com, faruk.geodu@gmail.com.

The study of land use changing patterns in the coastal areas of Bangladesh plays a significant role for a sustainable environmental situation and conservation. Land use pattern reflects the character of a society's interaction with special reference with its physical environment, a fact

that becomes obvious when it is possible to reveal different economic and social systems occupying the same or similar environments. The present study shows that the land use of coastal areas are gradually changing i.e. diverse, competitive and alarming rate. The land use of coastal areas are using in different purposes viz. agriculture, shrimp farming, salt production, forestry, ship-breaking yards, ports, industry, settlements, wetlands etc. The study reveals that land use in this area in 1950 had been mainly used for paddy cultivation, but due to human interferences the natural drainage system are greatly hampered and gradually salinity intrusion polluted the water, soil etc in the area. Moreover, in order to boost rice production in this area the World Bank and others helped with large-scale polderization in 1960–1980 (World Bank, 2005). As a result, artificial embankment hampered the drainage system and the whole low-lying marshy land became water logging which increasing the salinity intrusion within the next decade. Moreover, a historical tradition of shrimp farming, polders provided an opportunity for intensive shrimp farming. As a result, crop land and mangroves forest areas were gradually transferred to shrimp farming which created a social conflict in the locality. This paper attempts to describe the causes of major changes in land use pattern of the coastal zone of Bangladesh and identify the negative effects on the environmental degradation obviously considered as a man-made disaster in the area. The research has been conducted through intensive and rapid primary survey with structured, open and closed ended questionnaire survey in southern coastal zone of Bangladesh; review of available secondary literatures, one to one interview with experts in land use sectors. Finally, the paper described the suggestive measures to address the problem in coastal land management.

**Abstract: 11104**

### **CARBON SEQUESTRATION POTENTIAL OF BAMBOOS *VIS-À-VIS* FAST GROWING TROPICAL TREES**

**Sanjay Singh, R. S. Prasad, Srikanti Kumari, S. P. Mishra and R. Das**

Molecular Biology and Tree Physiology Laboratory Institute of Forest Productivity  
Aranyodaya, NH-23, Lalgutwa, Ranchi- 835303, India  
E-mail: [sanjaysingh@lycos.com](mailto:sanjaysingh@lycos.com)

Bamboo is one of the most productive and fastest growing plants which make it a valuable sink for carbon storage. The fastest-growing bamboo species may grow up to 1.2 m a day and carbon content comprises usually about 50% of the total biomass. Thus, bamboo can easily compete with the most effective wood species in terms of carbon sequestration capacities. Bamboo has several advantages over tree species in terms of sustainability and carbon fixing capacity. Besides higher biomass, bamboo has other advantages over wood as a carbon stock. Unlike woody crops bamboo offers the possibility of annual selective harvesting and removal of about

15-20% of the total stock without damaging the environment and stock productivity. Over 90% of bamboo carbon can be sequestered in durable products such as boards, panels, floors, furniture, buildings, cloth, paper and activated charcoal. These products have a very long life span and may retain carbon for several decades. Available studies conclude that bamboo biomass and carbon production may be 7-30% higher compared to the fast growing wood species. For instance *Bambusa bambos* has been measured at a total above ground biomass 287 t/ha with a mean annual production of around 47.8 t/ha/year, almost twice that of the Eucalyptus clones. In the present study carbon sequestration potential of 10 bamboo species viz., *Bambusa bambos*, *B. balcooa*, *B. multiplex*, *B. nutans*, *B. tulda*, *B. vulgaris* var. *green*, *B. vulgaris* var. *striata*, *Dendrocalamus membranaceus*, *D. strictus* and *Sasa palmata* was evaluated in comparison with 7 fast growing tropical tree species (*Acacia auriculiformis*, *Anthocephalus chinensis*, *Bombax ceiba*, *Gmelina arborea*, *Melia azadirachta*, *Pongamia pinnata* and *Tectona grandis*). The rate of net photosynthesis varied in these bamboos from 1.55  $\mu\text{mol m}^{-2} \text{s}^{-1}$  to 10.12  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . Species like *B. tulda* and *D. strictus* recorded photosynthesis rates comparable or better than many fast growing trees. The trends were similar in case of chlorophyll content and photosynthetic enzymes. The study indicates that bamboo plantations possess climate change mitigation advantage especially in the natural growing range.

**Abstract: 11109**

### **IMPACT OF SOME WEATHER PARAMETERS ON PRODUCTIVITY OF PADDY IN HOWRAH DISTRICT OF WEST BENGAL, INDIA**

**K. Mukhopadhyay, A. Banerjee, S. Murmu, S. Banerjee, K. Nag and B. Sarkar**

Howrah Krishi Vigyan Kendra, Bidhan Chandra Krishi Viswavidyalaya, Indian Council of Agricultural Research, Jagatballavpur, Howrah, West Bengal, India  
E-mail: howrahkvk@gmail.com

Howrah district, located in between the river Hooghly and Roopnarayan, is the smallest agricultural district of West Bengal. This district has a variety of agro-ecological situations ranging from new alluvial to old alluvial as well as coastal saline situation. Traditionally, paddy is predominantly cultivated here over the years as majority of the area is under low to medium land situation and till now it is the main crop of the district. Ninety percent of the farmers of this district inclusive of all the categories are engaged in paddy cultivation. But, comparative data for the year 2007-08 showed that the district has a much lower degree of productivity (2199 kg/ha) than the state average (2573 kg/ha) and ranked 13<sup>th</sup> in terms of yield among the eighteen agricultural districts of West Bengal.

For the last few years it has been revealed that the production of paddy is highly fluctuating with abrupt changes in some of the weather parameters. Considering the fact that the other major

parameters that influence the productivity of paddy like inclusion of high yielding variety, adoption of new technologies including farm mechanization, better plant protection measures etc. behaved more or less constant, the present study was designed in order to find out the relationship of some important weather parameters like temperature and rainfall with the productivity of paddy of all the three seasons – *Aus*, *Aman* and *Boro* in Howrah district of West Bengal. The study is purely based on secondary information about weather data availed from Meteorological Department as well as production data obtained from Department of Agriculture, Government of West Bengal, India.

The data showed that rainfall and both maximum and minimum temperature are negatively correlated with overall rice productivity of the district and among them maximum temperature had the highest negative influence over the productivity. Influence of weather parameters on different seasons' paddy also studied and it has been found that maximum temperature was significantly and negatively correlated with *Aus* paddy productivity which probably due to the fact that very high temperature during growing season of *Aus* paddy may affect it's yield. Positive correlation value with minimum temperature also supported this trend. Non-significant correlation between paddy productivity and rainfall inferred that rainfall did not have a major impact over the *Aus* productivity. Negative correlation with rainfall was found highest in case of *Aman* than the *Aus* or *Boro* paddy productivity probably due to excessive rainfall during *khariif* season. When the effect of temperature has been considered over the productivity it has been observed that maximum temperature was negatively correlated with *Aman* but positively with *Boro* paddy productivity which clearly due to pronounced effect of temperature as higher temperature during the growing season of *Boro* paddy increases crop yield and vice-versa in case of *Aman* paddy. This trend also supported when *Boro* productivity was found negatively correlated with minimum temperature as it is cultivated during cold winter months affecting crop yield drastically.

**Abstract: 11113**

## **THE CONSEQUENCES OF CLIMATE CHANGE FOR PRECIPITATION TRENDS IN BANGLADESH**

**Mohammad Shohrab Hossain Sarker, Grant Bigg, and Juergen Zimmerer\***

Department of Geography, The University of Sheffield, Sheffield, UK

\* Department of History, The University of Sheffield, Sheffield, UK

E-mail: shohrabsarker@yahoo.com

Bangladesh is the most vulnerable country in the world to natural disaster like floods, cyclones, river bank erosion and sea level rise which are related to temperature and precipitation. In this paper we are going to discuss the change of rainfall pattern due to climate change. Historical monthly rainfall data has been use to find the current rate of rainfall change of the region. We

will compare this rate to IPCC coupled climate models for predicting the future rainfall pattern of the country.

In this research we found the precipitation trends in the monsoon season are positive with 99% statistical significance in all the regions, except the northwest, which is not significant even at the 95% level. The southeast and northeast regions show a very large upward trend, with rates of 28.7 and 24.5 mm yr<sup>-1</sup> respectively in the monsoon season. However, the annual rainfall of the country is increasing at the rate of 28 mm yr<sup>-1</sup> and the monsoon rainfall is increasing at a rate of 16 mm yr<sup>-1</sup>, at the 99% significance level. These results lead to a risk of increasing flooding, as 40% of the country is low-lying.

**Abstract: 11123**

### **CLIMATOLOGICAL CLASSIFICATION OF BANGLADESH**

**Keka I. A.<sup>1</sup>, Rahman M.M.<sup>1</sup> and Matin I.<sup>2</sup>**

<sup>1</sup>Department of Physics, University of Rajshahi, Rajshahi-6205, Bangladesh

<sup>2</sup>Department of Civil Engineering, Rajshahi University of Engineering & Technology,  
E-mail: ishrat\_keka@yahoo.com; mrphy.ru@gmail.com; imatinbd@yahoo.com

Different combination of processes in the earth's climate system produced many variations in climate from place to place and from time to time. It is common phenomenon in nature that no two places in the world have exactly the same climate, but it is possible to identify some regions in which the climates can be said to be similar. On that principle the climatic classification has been developed. Six different climatic classification methods are used in this study: De Martonne's Climatic Classification, Gorczynski's Climatic Classification, Russo's Climatic Classification, Scheffer's Climatic Classification, Koppen's Climatic Classification, Thornthwaite Climatic Classification.

**Abstract: 11125**

### **EXTENT AND SEVERITY OF GROUNDWATER ARSENIC AND SALINITY CONTAMINATION AND ITS ENVIRONMENTAL IMPACT IN SOUTHWEST COASTAL AREA (SHYAMNAGAR THANA) OF SATKHIRA DISTRICT, BANGLADESH**

**S. M. Shafiuzzaman**

Institute of environmental Science, University of Rajshahi, Rajshahi-6205, Bangladesh  
E-mail: smshafiuzzaman@yahoo.com

The area under study is a part of Bengal basin and lies in the southwestern coastal zone of Bangladesh, where groundwater is highly saline and peoples are facing tremendous safe water

crisis. Groundwater arsenic is one of the important additional burdens. The study is important to make an overview of the causes, severity and extends of arsenic and salinity contamination in groundwater and its impact on local environment.

The research has conducted to apply field observation data and groundwater sample analysis data from laboratory. To measure water quality especially arsenic and salinity, samples have collected from 12 well locations of 12 unions of Shyamnagar Thana. Samples were produced manually and were stored in clean plastic bottles. Arsenic concentration have been measured by using standard method of analysis and by equipments, Atomic Absorption Spectrophotometer, Simadzu AA-6800 in Central laboratory and IES laboratory of Rajshahi University. Salinity has been measured in each station by using potable Electro Conductivity (EC) meter (HANNA HI 7039 P). Other metal ions and anions- Na, Ca, Mg, Fe,  $\text{CO}_3^{2-}$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$  has also measured to apply standard method. pH, and temperature has been determined in each station by using potable pH meter (HANNA Pocket pH meter), Fahrenheit thermometer during the collection of water sample.

The study result shows chemical constituents especially Arsenic and salinity in groundwater of 12 stations exceed the permissible limit (WHO and Bangladesh recommended value), except few samples. Concentration of As ranges from 0.04 to 0.25 mg/l. Salinity is high in maximum area. Among the 12 samples, seven samples falls under the zone of 'severe problems' where EC ranges from 11500  $\mu\text{S}/\text{cm}$  to 25000  $\mu\text{S}/\text{cm}$ , Two samples fall under the zone of 'increasing problem' where EC ranges from 5000  $\mu\text{S}/\text{cm}$  to 5500  $\mu\text{S}/\text{cm}$  and rest of three samples are in the 'no problem' where EC ranges from 3000  $\mu\text{S}/\text{cm}$  to 4000  $\mu\text{S}/\text{cm}$ . Ca and Mg range from 67 to 83 mg/l and 21 to 31 mg/l respectively. Fe concentration ranges from 21 to 31 mg/l. Other chemical parameters, Na,  $\text{CO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  result exceed the permissible limit except few elements. pH varies from 7.1 to 8.2, which indicate water is practically neutral to alkaline.

Peoples are facing serious problem due to scarce of pure water in study area. Arsenic impact did not become severely in maximum area. A few numbers of arsenic patients were found in some places. But expansion of salinity causes a lot of changes different kinds of vertebrates, invertebrates, crops, woody and fruit trees. Percentages of people are suffering in diarrhea, dysentery, typhoid, jaundice etc diseases. Concrete structure, road and telephone and electric polls are damaging due to the influence of salinity in this area.

To overcome this predicament, harvesting rainwater and purify pond or surface water, proper planning, awareness and watershed management are necessary.

**Abstract: 11132**

## **AEROBIC BIOLOGICAL TREATMENT OF INDUSTRIAL WASTEWATER**

**Mohammad Zakir Hossain Khan and M. G. Mostafa**

Institute of environmental Science, University of Rajshahi, Rajshahi-6205, Bangladesh

E-mail: engr.zakir@yahoo.com

The rivers in Bangladesh are mainly used for navigation purpose and to carries run-off water from adjoining agricultural lands. These rivers also receive un-treated wastewater from the industries located on both sides of their banks. The industries include, pharmaceutical, paper, dyeing-finishing, chemicals, vegetable oils etc. Most of the industries do not have any effective treatment plant. Therefore an Effluent Treatment Plan (ETP) is required to save the water bodies from pollution. The aim of this study was to treat the pharmaceutical wastewater using biological process to save the river and other surface water bodies from pollution. This study was carried out an aerobic biological treatment process using biodegradable bacteria enriched sludge and designed an ETP for the biological treatment of the wastewater. A batch type aerobic sludge reactor with operating volume 10 L was used and the reactor was operated for a period of 15 days. Air was supplied through the bottom of the reactor at room temperature ( $30\pm 1^\circ\text{C}$ ) to survive bacteria necessary for the biological process. Some important physical parameters for the wastewater including pH, TDS, EC, TSS and COD were analyzed.

The study results illustrates that average pH and EC of the wastewater were increased from 7.1 to 8.8 and 506 to 1150  $\mu\text{mol}/\text{cm}$ , respectively. The results also show that TSS was increased and COD was decreased indicating the improvement of wastewater quality after the treatment process. The overall performance of the reactor was satisfactory. Finally an ETP was proposed for the pharmaceutical wastewater treatment.

**Abstract: 11135**

### **ASSESSING THE SPECIES CONTRIBUTION TO ABOVEGROUND BIOMASS IN A TROPICAL WET EVERGREEN FOREST IN SRI LANKA**

**M. D. P. Kumarathunge and M. C. M. Iqbal**

Plant Biology, Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka  
E-mail: dushan@ifs.ac.lk

Monitoring carbon dynamics in tropical forests is important in the context of mitigating adverse effects of global climate change. Long term monitoring of tree communities is necessary in natural forests to determine their carbon content in carbon dynamics. However, assessing all the interesting trees in a sample plot is not worthwhile, since in the long run all the tree species do not contribute to the aboveground carbon content equally.

We estimated the aboveground biomass (AGB) in a 25 ha forest dynamic plot, in an undisturbed site of *Sinharaja*, a wet evergreen forest in Sri Lanka. AGB of 144 abundant species were estimated separately and their contribution to the total aboveground biomass (TAGB) was determined. Only seven species (4.86% of trees) accounted for 50% of the TAGB. Of these species, *Messua nagassarium* contributed the most with 22.5% of the TAGB, followed by

*Cullenia ceylanica*. . The individual contribution of 65 species was less than 0.01% which is negligible. Only 3% of trees had DBH of >50 cm and these accounted for 35% of the TAGB. The highest individual contribution were from trees >70 cm DBH having a density of 11.36 trees/ha, which contributed 14.6% to the AGB. In *Messua nagassarium*, 57.78% of the TAGB were from trees greater than 50 cm DBH and 36.82% in *Cullenia ceylanica*. This study shows larger trees, though their density is lower, contributed most to the TAGB. Natural or anthropogenic destruction of large trees would significantly alter the carbon dynamics in these forests even though large number of smaller trees exists. Thus assessing all the trees in a sampling area is not necessary to determine the carbon dynamics in natural forests. Assessing the highly contributing (generally >1%) species would be sufficient enough to make conclusions about the carbon dynamics. Further research is required to verify these findings in relation to the growth rate such as slow growing or fast growing species.

**Abstract: 11139**

## **CLIMATE CHANGE: RIVER MORPHOLOGY AND LOCAL INDIGENOUS ADAPTATION TECHNIQUE IN JAMUNA RIVER**

**Mahmud Hasan Tuhin, Rahman Mohammad Arifur, Md. Mosiur Rhaman  
Md. Munsur Rahman**

Institute of Water and Flood Management, Bangladesh University of Engineering and  
Technology, Dhaka- 1000, Bangladesh  
E-mail: tuhiniwfm@gmail.com

Bangladesh is one of the most vulnerable countries to the effects of climate change. Global warming with higher associated rainfall and relative sea level rise, will likely cause significant changes in sediment and flood regimes. As a result, large rivers like the Jamuna may be disturbed requiring long periods of adjustment in fluvial processes and morphological forms. Sudden water level rise, flooding and bank erosion of this river influence life and livelihood of several millions of people. Among different morphological changes, riverbank erosion is a common and frequent natural hazard in Bangladesh. The rate of erosion in the Jamuna River is the highest among the three major rivers of Bangladesh. People lived near the river bank are adapted with bank erosion. Sometime they applied indigenous technique for erosion protection by using locally available materials, where the erosion rate is minor. To protect the house, village and community buildings from erosion, local people commonly build bank protection structures by using locally available materials. In reality this is an adaptation technique of the local people lived near the river bank The objective of this study is to identify the sustainable erosion protection measures practiced by the local people and the process of protection and materials

used for the protection work. Local people's knowledge of erosion, erosion protection works, social response of erosion were also evaluated by using different PRA technique. FGD and interview were conducted in different sites for collecting information.

Local people prefer the locally available materials for the erosion protection work. It is found that, bamboo is available in all sites and commonly used for the erosion protection measures. So bamboo is the main material for using erosion protection. Other than bamboo, straw mat, Khaisha (long grass grown in charland), bamboo piling with sand fill bag dumping, Dhaincha and Banana plant is used for the local erosion protection measure. Using green fencing of Banana and Dhaincha plant against erosion is also a common practice. In some places, Bandal like structures are also observed. Construction and maintenance cost is very low and easily maintained by the local people. But according to the local people it is not a total solution against the river bank erosion. For the effective erosion protection, massive engineering works such as revetment is preferred by the local people in substantial erosion prone area. But for a short time period, local knowledge based protection measures are effective and sustainable in low water flow area where erosion is insignificant and in branch channel.

**Abstract: 11145**

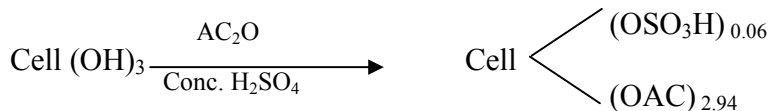
**SYNTHESIS AND CHARACTERIZATION OF CELLULOSE ACETATE FROM ENVIRONMENTAL POLLUTANTS CELLULOSIC WASTES OF TEXTILE INDUSTRY**

**A. B. M. Fakrul Alam and Md. Ibrahim H. Mondal**

Department of Applied Chemistry & Chemical Engineering, University of Rajshahi, Bangladesh  
E-mail: mihmondal@yahoo.com

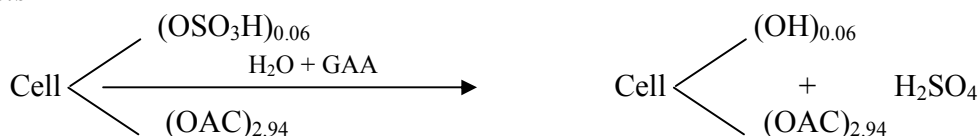
Cellulosic wastes of different garment and textile industries are always polluted the environment in different ways. Huge amount of cellulosic wastes are deposited as textile wastes in different garment and textile industries and that have virtually no use. It can easily be used to produced valuable products like cellulose acetate (CA) and other cellulose derivatives, and that will ultimately reduce the pollution problems. Preparation of CA from cellulosic waste of textile and garment industries can be considered a feasible alternative source for generating value-added product and contributing to solving the environmental pollutants. CA was synthesized in glacial acetic acid (GAA) and subsequently acetic anhydride (AC<sub>2</sub>O) in presence of conc. H<sub>2</sub>SO<sub>4</sub> reaction medium by the following reactions:

*Acetylation*



Cellulose

*Hydrolysis*



### High-acetyl cellulose acetate

Single step acetylation gives only low substituted product. Highly substituted CA can be prepared by performing multisteps acetylation of the cellulosic wastes. The synthesized crude CA was washed with distilled water, stabilized with  $\text{Na}_2\text{CO}_3$  and then dried in a desiccators over  $\text{P}_2\text{O}_5$ . In this way, it was possible to produce low cost and different grades of cellulose acetate.

The synthesized CA was characterized and investigation of its physical characteristics was done. Solubility, acetyl content, acetic acid content, degree of substitution, and molecular weight of CA were increased gradually with the increase of the number of reaction steps, although fourth step attained optimal. The acetyl and acetic acid content of CA from 1 to 7 reaction steps were 39.95 to 44.25 and 55.73 to 61.73 respectively. Similarly, degree of substitution and molecular weight of CA were 2.47 to 2.94 and 74249 to 121437, respectively.

**Abstract: 11149**

## **NGO, CLIMATE CHANGE AND ENVIRONMENTAL POLITICS IN BANGLADESH**

**Fowzia Gulshana Rashid Lopa**

Regional and Rural Development Planning, Asian Institute of Technology (AIT), P.O. Box 4,  
Klong Luang, Pathumthani 12120, Thailand  
E-mail: st109566@ait.ac.th

This research sets out to deal with the role of NGOs in national political agenda on climate change in Bangladesh. More specifically, it is an attempt to investigate NGOs' participation in decision making process to prepare national policy, action plan on climate change and implementation these agendas into practice. With this view, firstly, it observes the current position of Bangladeshi NGOs describing the evolution of climate change discussions and NGOs' initiatives in development discussions. Secondly, it evaluates how NGOs act as pressure group to prepare national policy and action plan on climate change addressing the issues of dialogue, policy formulation, policy changes and legal structures. Basically, this objective critically examines how they understand climate change, how this understanding shapes national political agendas on climate change, how or whether they involve in policy changes and legal structures and how or whether they provide assistance in monitoring policy implementation. Thirdly, it tries to see NGOs' activities/implementation process on climate change ensuring whether their positions comply with the national policy/plan or not. Essentially, this objective assesses how these agendas translate to projects on the ground by NGOs, how well each NGO facilitates adaption, mitigation and awareness capacities in the communities. Finally, it draws a conclusion on how NGOs ensure their participation in the nstage of policy formulation to implementation negotiating international treaties (UNFCC and KP) on climate change. *Qualitative* research approach is applied for this study. It uses the several research techniques

such as: in-depth case studies, structured/semi-structured interviews, participant observations, informal interviews/discussions, literature review, article analysis and documentary searches.

**Abstract: 11158**

**FISH SPECIES DYNAMICS IN BRUSH CUM VEGETATION PARK (KATHA)  
FISHERY OF ROKTODHA BEEL**

**Md. Amimul Ehshan\* and Abdus Salam Bhuiyan<sup>1</sup>**

\*Institute of Environmental Science, University of Rajshahi, Bangladesh,

<sup>1</sup>Department of Zoology, University of Rajshahi, Rajshahi 6205

E-mail: amisan72@yahoo.com

The *Katha* fishery is basically a fish attracting device popularly known as brush-park. An investigation was conducted on brush-and vegetation park of Roktadaha beel, Bogra from May'07 to February'08. Dynamics of fish and prawn species depending on trophic-level groups, tropho-spatial assemblage and habitat preference in floodplain brush park was analyzed. During study period a total of 22 katha were observed. In the investigation 42 species of fish and prawn were recorded. Contribution of resident fish and prawn species was 63.70% with *Chanda nama* as dominant species; and migratory 35.35% with dominant species *Pseudotropius atherinoides*. The rest was (0.95%) alien species with dominant species *Barbonemus gonionotus*. In percent composition by weight resident species were also dominant (52.43% with *Chanda nama* as dominant species) following migratory (26.0% with *Wallago attu* as dominant species) and a remarkable (21.56% with the dominant species *Barbonemus gonionotus*) contribution of alien species.

In general categorization by number cat fish (45.87%) was the most dominant group followed by perches (28.69%), prawns (10.58%) minnows (8.18%), eels (2.89%), others (2.11%), carps (1.03%) and murrells (0.65%). By weight cat fish (35.75%) was again the most dominant group followed by carps (30.25%), eels (10.01%), perches (9.99%), minnows (5.13%), prawns (3.85%), others (2.52%) and murrells (2.49%). Among cat fish *Pseudotropius atherinoides* was the most dominant species both in number and weight (85.16% and 70.27%). In case of all species it was the most dominant in number (39.19%) and second dominant position in weight (9.67%) after *Wallago attu* (14.67%).

Considering trophic level and composition in number abundance surface feeder was the most dominant group (77.13%) followed by bottom feeder (21.63%) and column feeder (1.24%). While in weight composition bottom feeder (49.32%) were the most dominant group followed by surface feeder (45.47%) and column feeder (5.21%).

According to food habit and numerical composition planktivore (48.69%) was found to be the most dominant group with dominant species *Pseudotropius atherinoides* (80.22%) following

insectivore (28.40%) with dominant species *Chanda nama*, omnivore (10.74%) with dominant species *Macrobrachium sp.*, predator (8.13%) with dominant species *Mystus tengra*, detritivore (3.17%) with dominant species *Macragnathus pancalus*, benthivore (0.56%) with dominant species *Macragnathus armatus* and herbivore (0.32%) with dominant species *Barbonemus gonionotus*. On the other hand considering weight planktivore (34.65%) was the most dominant group with dominant species *Pseudotropius atherinoides* (70.27%) following predator (26.10%) with dominant species *Wallago attu* 56.2%, detritivore (10.11%) with dominant species *Macragnathus pancalus*, omnivore (9.59%) with dominant species *Pangasius hypophthalmus*, benthivore (7.09%) with dominant species *Macragnathus armatus*, herbivore (3.82%) with dominant species *Ctenopharyngodon idellus*.

During investigation *katha* fishing was found to be an important environment concern on fisheries biodiversity both from exploitation and conservation aspects. Although fish parks are controversial in many areas, however, when properly managed the structures can be altered from simple fish attracting devices to a form of aquaculture whereby net production can be increased.

**Abstract: 11170**

## **COMPARISON OF YIELD PERFORMANCE OF HYBRID AND INBRED RICE VARIETIES UNDER DIFFERENT LEVEL OF INTERMITTENT IRRIGATION**

**Sheikh Helena Bulbul, Md. Safinur Rahman and Md. Redwanur Rahman**

Institute of Environmental Science, University of Rajshahi, Rajshahi, Bangladesh

E-mail: redwan\_rahman@lycos.com

A study was conducted at Bangladesh Rice Research Institute (BBRI), experimental farm, Gazipur, a semi-drought prone area during the period of November-May, 2009. The objective was to compare of effects of water saving irrigation regimes on yield and yield contributory parameters, water use efficiency, water productivity and profitability of AWD (Alternative Wetting and Drying) for Boro rice. The experiment included two varieties, namely BRRI dhan29 and BRRI hybrid2 and four irrigation management regimes, ranging from continues standing water to 25cm water disappearance below 5-7cm from the soil surface. Grain yield of BRRI dhan29 reduced remarkably when irrigation water disappearance and, the reduction of grain yield reduced with increasing the rate of water disappearance. Contrary, the positive impact regarding irrigation water disappearance on grain yield was found for BRRI hybrid dhan2. The grain yield of BRRI hybrid2 increased with increasing irrigation water disappearance up to

20cm. It might be due to the water use efficiency of hybrid variety is much higher than inbred variety.

**Abstract: 11172**

**INFLUENCE OF ATMOSPHERIC TEMPERATURE ON FLOWER  
PRODUCTION OF TUBEROSE (*POLIANTHES TUBEROSA* L.) IN WEST BENGAL**

**S. Gonsalves<sup>1</sup>, A. K. Pal<sup>1</sup>, B. Tamang<sup>1</sup> and G. Saha<sup>2</sup>**

<sup>1</sup>Department of Floriculture and Landscaping, <sup>2</sup>Department of Agricultural Meteorology and Physics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, West Bengal.

<sup>1</sup>E-mail: sreela\_hort@rediffmail.com.

Among the important ornamental bulbous plants grown in West Bengal as well as India, tuberose (*Polianthes tuberosa* L.) occupies a prime position due to its popularity and economic potential as a cut flower, loose flower as well its potential in perfume industry. Among the single flowered types Calcutta Single variety is extensively used as loose flower and for extraction of essential oil, while Prajwal (a cross between Shringar and Mexican Single cultivars) is more popular as cut flower. Among the double flowered types Calcutta Double is preferred as cut flower, loose flower and also for oil extraction. Temperature is most important factor affecting growth, flower initiation and subsequently flower and bud development. A field experiment was conducted at Horticulture Research Station, Mondouri (23<sup>0</sup> N latitude, 89<sup>0</sup> E longitude and altitude of 9.75 m above mean sea level), Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal during 2009-2010, to study the effect of temperature on flower production of tuberose varieties (Calcutta Single, Calcutta Double, Prajwal) planted in mid February'09 at a spacing of 30cmX30cm in plots measuring 1.5mtX1.2mt. The maximum flower production of Calcutta Single (78 spikes per plot), Calcutta Double (10.33 spikes per plot) were obtained in April, 2010, while in Prajwal (11 spikes per plot) the same was obtained in December, 2009. Among the three varieties, flower yield (No. of spikes per plot) of Calcutta Single was found to be positively correlated with accumulated monthly Growing Degree Days (GDD). Flower yield of all three varieties were found to be positively correlated with monthly average sunshine hours during the flowering period. The flowering started early (from June, 2009) in both Calcutta Single and Calcutta Double. The flowering in Calcutta Single increased with high GDD during March (729.7° C days) and April (766.5° C days), 2010.

**Abstract: 11182**

**AGRICULTURAL ADAPTATION DUE TO SALINITY INTRUSION IN THE SOUTH-WESTERN COASTAL REGION OF BANGLADESH**

**Md. Mujibor Rahman and Nusrat Jahan**

Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh

E-mail: mujibku@gmail.com, jahan.purba@yahoo.com

In Bangladesh where agriculture is the largest sector of the economy, agricultural production is under pressure from increasing demands for food. A large percentage of the population is already vulnerable to a range of natural hazards with increasing saline variability and salinity intrusion expected to intensify the situation further by causing more frequent and intense salinity intrusion. This thesis work has been done to show some of the adaptation measures regarding agricultural sector to deal with salinity intrusion targeting Munshiganj Union of Shyamnagar Upazila of Satkhira District which is one of the most salinity prone areas of Bangladesh where 66.32% of the total population is involved with agriculture. Present salinity status of this area is so high that affects the agricultural practices from various points of view like crop diversity and cropping pattern, fertilizer fate, pesticide fate, irrigation water use, traditional agricultural practices, change in production economy and fisheries etc. Because of the changing cropping pattern for the higher production some of the local rice varieties are going to be abolished. For this changing cropping pattern high rate of fertilizer and pesticides is needed which is going to deteriorate the normal cycle of soil fertility. High yield varieties need more water for irrigation. But there is a shortage of fresh water and for the shortage of irrigation water it is losing its productivity. Due to salinity intrusion traditional agricultural practices have been disappeared and that is altering the capacity of soil fertility day by day and for this reason production cost is being higher than the past time which in turn hampering the productivity of that area. Salinity intrusion is also hampering fresh water fish culture that relates the malnutrition condition of the existing community. Some adaptive steps like introduction of alternative farming system, short duration crop varieties (e.g, BR-28) farming, saline tolerant crop varieties (BR-47) cultivation and crab fattening could be taken to cope up with the increasing salinity condition for the betterment of the local people and sustainability of the area.

**Abstract: 11186**

**RECOVERY OF RAW MATERIALS AND DEVELOPMENT OF WASTE  
MANAGEMENT IN PENICILLIN DRUG INDUSTRIES TO REDUCE THE  
ENVIRONMENTAL POLLUTION**

**Anjon Kumar Mondal, A. H. K. M. Kamruzaman, Mst. Rokhana Khatun,  
Md. Abul Kalam Azad and A.T. M. Kamrul Hasan**

Department of Applied Chemistry and Chemical Engineering  
Rajshahi University, Rajshahi-6205, Bangladesh  
E-mail: alishaabir@yahoo.com

Environmental pollution is now the most important alarming issue for the people of Bangladesh. Among the environmental pollution, water is the major issue for human health hazard. Surface water as well as ground water is being continuously polluted by the waste water generating from the different industries which is drained out without any treatment. Large amount of solvent such as methylene chloride, isopropyl alcohol, ethyl acetate are used for the production of antibiotic products. After distillation, these recovered solvents are reused in the process. Penicillin drug industry produces huge amount of residue which is obtained from the distillation of solvents used in different stages during the synthesis of Amoxicillin T. H., Flucloxacillin-Na and Cloxacillin-Na. This residue contains various components such as, methyl acetoacetate, 2-ethyl hexanoic acid, pivalic acid, small amount of solvents, unreacted raw materials and some nitrogenous and sulphur compounds. In centrifuge stage huge amount of mother liquor also generated which contains triethyl amine. These are toxic and it is required to reduce the toxicity of effluent for better environment.

This work deals to recover pivalic acid from the residue which obtained from the distillation of methylene chloride and triethyl amine from the mother liquor obtained after centrifugation of Amoxicillin crystal. Simple and vacuum distillation method has been used in this experiment. It has been found that 70% triethyl amine having 99.6% potency is possible to recover which can be used again in the process. Large amount of pivalic acid having potency 77.3% has been recovered which can be reused and also be sold in the market. Pivalic acid may also be converted to pivaloyl chloride which is also the key raw material for Amoxicillin production. After recovery of this valuable materials negligible amount of effluent we got which is drained out after treatment. All these results indicate the importance to recover the valuable components present in the effluents which can be reused in the process to reduce the production cost and to make a pollution free environment around the penicillin drug industries.

**Abstract: 11191**

**A STUDY ON DIFFERENT IMPACTS OF CLIMATE CHANGE IN BANGLADESH**

**M Jahangir**

Institute of Environment Science, University of Rajshahi, Bangladesh

E-mail: prof.mjahangir@yahoo.com

Bangladesh is a highly vulnerable country in the world to Human induced changes in the global climate. This study focuses on the possible impacts of climate changes in Bangladesh through the sea level rise, temperature rise, increased evaporation, salinity rise and rainfall rise and also discussed on adaptability. According to the study, the minimum atmospheric temperature of Rajshahi increased to 7.69% in last 40 years. Highest salinity of river Passur of Khulna and river Kirtankhola of Barisal are increased accordingly 23 and 2 $\frac{2}{3}$  times in last 30 years. The maximum tidal ranges are increased randomly in last 20 years at different selected meteorological river stations, such as Barisal, Khulna and Chapra for the rivers Kirtankhola, Passur and Betna. These are respectively 50%, 13.7% and 8.5%. But the value of Elachar station of the river Satkhira khal is increased vigorously, that is 136%. In correspondence to the water level of the rivers are not raised, due to the scarcity of fresh water coming through the hills surrounding Bangladesh. The rainfall intensity of last 37 years is increased. Six meteorological centers rainfall data are collected in this paper, which are two hilly areas, two plain lands and two coastal areas. The highest rainfall area of the country is Sylhet. The rainfall data from the Sylhet centre for 1971 to 2008 show that the annual average rainfall in the area is about 3252 millimeters and the increasing rate of rainfall is 31.25%. The annual average rainfall of other areas are respectively 2938, 2273, 2130, 2058, and 1839 millimeters of Chittagong, Rangpur, Dhaka, Barisal and Khulna, of which about 50% falls during the months of June, July and August. The increasing rates of rainfalls are respectively 16%, 12%, 14.28%, 11.76% and 26.6%. Some discussions are also made on infrastructures, drought, river bank erosions, floods, coral bleaching, Human health and biodiversity.

**Abstract: 11193**

**CLIMATE CHANGE INDUCED IMPACT ON TRADITIONAL AGRICULTURAL PRACTICES ON CHARs OF JAMUNA RIVER**

**Rahman Mohammad Arifur and Md. Mansur Rahman**

Institute of Water and Flood Management, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

E-mail: arif\_es36@yahoo.co.uk

Bangladesh is mainly composed of the floodplains and delta of three rivers, the Ganges (Padma), the Brahmaputra (Jamuna) and the Meghna. Extensive char areas have been created along the bed or basin of these rivers. *Charlands* are the sandbars that emerge as islands within the river channel or as attached land to the riverbanks. The study area was selected on the basis of stability of the char (newly emerge char, less stable char, stable char). The research would be conducted through interdisciplinary approach. Different socio technical tools would be used to analyze the problem. Local people participation in the research process would be ensured by using PRA tools like Discussion tools (Focus Group Discussion, Semi Structure Interview) and Diagramming tools (Seasonal Calendar).

The present study assesses the loss of agricultural production and livelihood impact due to recent unusual raise of water level at chars of Jamuna River. The water level data at Sirajgonj Hard point it is found that from Apr 24 to 3 May in 2010 the average water level is 10.84 m (PWD) where as at the same period in 1988, 2007, 2008 and 2009 the average water level is 9.05, 8.94, 8.94, 8.41 m (PWD). This indicates that the present year water level is about 2 m high compare to the previous year water level. The Char dwellers mainly depend on agriculture and agriculture related activities. Opportunities for off farm activities are marginal. The harvesting period of Kharif crops like maize, sweet potato, ground nuts, pulses and rice is the month of April. According to FGD three-fourth of the total production of Kharif crops has been lost due to raise the unusual water level during the last week of the month of April. On the other hand the sowing of some crops like Jute seeds were not possible due to submerged of agricultural land. In addition due to water level hike all breeding ground (*locally known as Kole*) of chars of Jamuna are submerged. As a result the reproduction of fishes would be disturbed.

Agricultural and related livelihood practices contribute the two-third of the total yearly income of the char's dwellers. As a result the present agricultural losses hampered their economic condition adversely and also make their life vulnerable. In addition the ultra poor char dwellers can not pull themselves out of poverty.

**Abstract: 11204**

### **ELECTROCATALYTIC REDUCTION OF $\text{NO}_2^-$ : PLATINUM MODIFIED GLASSY CARBON ELECTRODE**

**M. A. Rashed, M. Saiful Alam, S. Hossain\* and M. A. Hasnat**

Department of Chemistry Shahjalal University of Science and Technology, Sylhet 3114, Bangladesh. \*Institute of nuclear science and tech, Bangladesh Atomic Energy Commission, Ganak Bari, Savar, Dhaka-1000, Bangladesh.

E-mail: mahtazim@yahoo.com, mah-che@sust.edu

Platinum particles were electrochemically deposited over glassy carbon (GC) to prepare GC–Pt electrodes. The electrocatalytic behaviors of this electrode have been compared with that of an ordinary polycrystalline (OPC) Pt and GC electrode in reducing  $\text{NO}_2^-$  at neutral medium. The as prepared GC–Pt electrode reduced  $\text{NO}_2^-$ , exhibiting double–peak reduction waves. The reduction performance of this electrode was noticed at least 7.8 times higher than that of an OPC Pt electrode. The sensitivity of the GC–Pt electrode was found to be enhanced by the temperature rise. A consecutive mechanism,  $\text{NO}_2^- \rightarrow \text{NO} \rightarrow \text{NH}_4^+$ , over the as prepared GC–Pt electrode has been investigated.

**Abstract: 11205**

**INVESTIGATION OF DISSIMILAR BEHAVIOR OF AG(POLY) AND GC(POLY) ELECTRODES TOWARDS THE NITRATE ( $\text{NO}_3^-$ ) REDUCTION**

**M. Saiful Alam, M. A. Rashed, M. S. Hossain\*, M. H, M. Karim and M. A. Hasnat**

Department of Chemistry, Shahjalal University of Science and Technology, Sylhet–3114, Bangladesh. \*Institute of nuclear science and technology, Bangladesh Atomic Energy Commission (AEC), Savar, Dhaka, Bangladesh  
E-mail: mahtazim@yahoo.com

In the present study, the nitrate ( $\text{NO}_3^-$ ) reduction reaction (NRR) in neutral medium using Ag (poly) and GC (poly) electrodes has been addressed. The comparative study of NRR was investigated at the Ag (poly) and the GC (poly) electrode by the hydrodynamic technique with a view to evaluating the various related kinetic parameters. The results demonstrated that the GC (poly) electrode substantially promoted the activity of the Nitrate reduction through an exclusive one step six-electron reduction forming  $\text{NH}_2\text{OH}$  as the final product whereas the one-step two electron NRR forming  $\text{NO}_2$  as the final product by Ag (poly) electrode

**Abstract: 11206**

**KNOWLEDGE ATTITUDE AND PRACTICES REGARDING PESTICIDE USE IN VEGETABLES CULTIVATION AND MARKETING IN BANGLADESH**

**Kazi Muhammad Wazir Hyder\* and Md. Al Mamun Sarkar**

\*Institute of Bangladesh Studies, Rajshahi University, Rajshahi. Email: kwhyder@gmail.com;  
Institute of Environmental Science, Rajshahi University, Rajshahi  
E-mail: mamunies@gmail.com

This paper attempts to discuss about the knowledge attitude and practices regarding pesticide use in vegetables cultivation and marketing in Bangladesh. Vegetables are one of the cash crops in Bangladesh. As a cash crop, it is expected that vegetables cultivation increase the farmer's income. With the surge of demand for vegetables, the number of farmers cultivating vegetables has been increasing in recent years. In addition, in late years, the appropriate use of pesticides, cultivation technology of less environment load, a sustainable farming technique are demanded in the vegetable cultivation in this country while safety of food and environmental problems attract the attention. The farmers who are cultivating vegetables mainly use pesticides in Bangladesh. They think pesticides have not only greatly improved vegetables production, providing a much needed increase in supplies of vegetables for an ever-growing human population but also reduced insect-born diseases. The farmers of this country do not know the rules, ordinance, legislation, etc regarding the uses of pesticides in relation to vegetables cultivation, protection and human welfare. They also have no idea or learning about the doses of using pesticides in vegetable cultivation. Though it has now been decided that all pesticides which recommended for the general use must be registered with the appropriate authority of the Government of Bangladesh but the farmers do not follow it. The continued use of pesticides is now being challenged. Knowledge and Practices regarding pesticide use in vegetables cultivation and marketing in Bangladesh are now taking the place of public concern. The growing public concern about the effects of the pesticides on human health, wildlife and environment are now tern into an important issue. In such situations, this study is done. This paper also focuses some points of the vegetables cultivation and pests' management. It also gives some recommendations to overcome the future challenges.

**Abstract: 11208**

**PARTICIPATORY DISASTER RISK ASSESSMENT  
(A CASE STUDY OF MONGLA UPAZILLA)**

**A. S. M. Tariqur Rabby\* and Susmita Sharmin Munia**

\*Research Associate, Urban and Rural Planning Discipline, Khulna University, Khulna, Bangladesh. Urban and Rural Planning Discipline, Khulna University, Khulna, Bangladesh,

\*E-mail: [rabby.planner@gmail.com](mailto:rabby.planner@gmail.com), [munia87@gmail.com](mailto:munia87@gmail.com)

Over the last decade, the disaster management sector in Bangladesh has experienced an influx of new concepts and approaches. Major approaches have switched from technology-based hazard control to community-based disaster risk management, which aims to reduce human vulnerability and build resilient communities [Ministry of Food and Disaster Management 2005]. For this purpose, disaster management committees are set up within each union 1). The committee prepares a disaster action plan and maps, showing hazard risks and resources in the

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union. Members of the community take part in this process utilizing PRA methods. It is the committee's responsibility to disseminate warnings, carry out evacuations and rescues, distribute relief and operate shelters, based on the disaster action plan. In community-based disaster management policy, it is important that the causes of vulnerability to disaster are fully discussed in the community and addressed in the disaster action plan, including gender issues as one of key elements that determine vulnerability. All three dimensions of vulnerability i.e. susceptibility to hazard, possibility of suffering damage, and recovery capacity [Watts & Bohle 1993; Adger 2006, etc] are affected by gender pattern of access and control over resources, gender roles and responsibilities, norms and so on [Enarson & Morrow 1998]. This paper describes the assessment of damage to physical assets, the level of vulnerability of the people of this area, the subsequent losses sustained across all economic activities and the impact of the disaster on both the national economy and household level activities and well-being. The analysis of the damage and loss assessment has identified the existing coping capacity of people in socio-economic context using PRA method. These should be formulated, adopted and implemented to reduce the impact of future disasters which are likely to be more intense due to climate change.

**Abstract: 11210**

**INFLUENCE OF IRRADIATION ON FENTON DEGRADATION OF  
BRILLIANT RED X-3B**

**M. Afsar Uddin, M. Maria Rahman and M. A. Hasnat**

Department of Chemistry, Shahjalal University of Science & Technology, Sylhet, Bangladesh  
Email: mahtazim@yahoo.com

Oxidative degradation of Brilliant Red X-3B was performed using Fenton's reagent in dark and in presence of light. The degradation rate was increased using Fenton's process in the order of UV > Visible > Dark. At pH 3.3 the maximum Fenton and photo-Fenton effect was noticed. At  $[H_2O_2]/[Fe(III)] = 3.5$ , a steady Fenton effect was observed and at  $[H_2O_2]/[Fe(III)] = 0.7$ , Fenton process in dark minimized the photo effect. The degradation rate was positively influenced by the temperature where the activation energy of degradation was evaluated as  $36.98 \text{ kJ mol}^{-1}$ .

**Abstract: 11213**

**EFFICIENT HYDROGEN PEROXIDE DECOMPOSITION ON BIMETALLIC PT-PD  
SURFACE**

**M. A. Hasnat, M. Maria Rahman, S. M. Borhanuddin, Ayesha Siddiqua,  
M. R. Karim and N. M. Bahadur\***

Department of Chemistry, Shahajalal University of Science and Technology, Sylhet-3114,  
Bangladesh; \*Department of Applied Chemistry and Chemical Technology,  
Noakhali Science and Technology University, Noakhali, Bangladesh  
E-mail: [mahtazim@yahoo.com](mailto:mahtazim@yahoo.com)

Hydrogen peroxide was efficiently decomposed on Pt-Pd surface deposited on Nafion membrane. Comparing the activities for the different materials, the activity for the decomposition of hydrogen peroxide was found to decrease in the order of Pt-Pd surface > MnO<sub>2</sub> > K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> > Au > Polycrystalline Pt plate. It was observed that the decomposition process followed bimolecular first order kinetics. In this paper, reason of efficient catalytic decomposition of hydrogen peroxide over bi-metallic Pt-Pd surface has been discussed.

Abstract: 11216

## **WETLANDS OF DHAKA CITY: ITS CHANGES, ENVIRONMENTAL CONSEQUENCES AND GOVERNMENT MANAGEMENT POLICY**

Shahabuddin, A. K. M and Raquib Ahmed

Institute of Environmental Science, University of Rajshahi, Bangladesh

**E-mail: [rauib\\_ahmed@yahoo.com](mailto:rauib_ahmed@yahoo.com)**

Dhaka city had a large number of water bodies, both big and small, which includes river, khals, lakes, low-lying areas etc. But the wetlands of Dhaka city have been shrinking with the passage of time. In recent years the speed of conversion of wetlands for housing and other infrastructures emerged as an alarming issue considering its adverse impact on environment. This study documented the extent of wetland change since 1960. To accomplish the study a topomap of 1960 and two satellite images (Landsat TM, 1988 and ALOS, VNIR, 2008) were used. During the total study period (1960-2008), the city has lost 33% of water bodies and 52% of lowlands. During the period 1960-88 the water bodies decreased about 30 hectares per year and between 1988-2008 decreased about 6 hectares per year and lowlands decreased 29 hectares per year between 1960-1988, 315 hectares per year between 1988-2008. It is clearly observed from the analysis of change in land use dimension of selected wetlands areas that wetlands are mainly converted to built-up areas. Population growth, rapid and uncontrolled urbanization and improper waste management are the main causes of wetland change. It is evident from the views of surveyed respondents mainly real estate companies and government organizations are involved in wetland loss. Land filling and encroachment are the main processes of wetland change. This trend of wetland change makes the drainage system of Dhaka city vulnerable and

city inhabitants are facing water logging problem. The water logging becomes a burden for the inhabitants of Dhaka city and creating adverse social, physical, economic and environmental impacts. This study carried out a through assessment of prevailing plans, acts, rules and regulations for wetland management. The present wetland management of the public agencies has been critically analyzed and their overlapping and conflicting areas were identified. The existing legal tools of different agencies are not exercised properly. Overlapping of functions among the agencies creates conflicts in management. The coordination status of government organizations are poor but the Private Land Development Companies ( PLDCs), local influential people and others, those are involved in wetland change are highly organized and well coordinated.

**Abstract: 11217**

## **CHANGING PATTERN OF LAND USE AND ITS IMPACT ON THE ENVIRONMENT OF DHAKA CITY**

**Md. Shahidul Islam and Raquib Ahmed**

Institute of Environmental Science, Rajshahi University

E-mail: raquib\_ahmed@yahoo.com

Dhaka, the capital and the most populated city of Bangladesh, is now the member of the “mega city” family of the world. Dhaka city had a large vegetation cover and water bodies, both big and small in size, which includes river, khals, lakes, low-lying areas etc. These water bodies have a very important role on drainage system and natural environment of Dhaka as well. But the wetland/lowlands of Dhaka city have been shrinking with the passage of time. The purpose of the study is to identify the nature and processes of urban land use change with emphasis on the spatial extent of change and its effect on environment. For this study Topographical map (Topo sheet, 1960) and Satellite images (Landsat TM, 1991 and Google images, 2008) were used. Remote sensing and GIS based Software (e.g. ArcGIS, Erdas Imagine and IDRISI Andes) and Statistical analysis was used for data processing and analysis of the study. Accuracy of Landsat-derived classified land use maps ranges from 60% to 70%. The analysis revealed a substantial growth of built-up areas in Dhaka City in the study period that resulted in significant decrease in the area of water bodies, cultivated land, vegetation and wetlands/lowlands. Urban land use change has largely been driven by the rapid population growth and socio-economic development. Rapid urban expansion through filling up low-lying areas and clearing of vegetation resulted in a wide range of environmental impacts, including quality of life. The land use maps produced in this study will perhaps, contribute to both in the development of a sustainable urban land use planning decisions and also for a short range forecasting of possible future changes in the growth pattern of Dhaka City. It is observed that land filling and encroachment are the main processes of land use change. It is also observed from the analysis of above mentioned map, images and other relevant maps that vegetation and wetland/lowlands of Dhaka city are changing very quickly. In 1960, water bodies, wetland/lowlands and vegetation area were 3725, 8982, 7615 hectares respectively. Where in 1991, the total areas of these three categories were 3196, 5829, 5418 hectares respectively. But in 2008, the total areas of water bodies, the wetland/lowland and vegetation were 2068, 4732, 2589 hectares respectively. Therefore, the area under both categories of wetland and vegetation were decreased remarkably. This study also indicates that

from 1960 to 2008 the area under water bodies decreased in total of 44.48%, wetland/lowlands decreased in total of 47.32% and vegetation area decreased in total of 66%, respectively. This trend of rapid land use change resulted in a wide range of Dhaka city and created adverse physical, social, economic and environmental impacts such as water logging, pollution, health hazard including habitat quality of life and loss of bio-diversity. This study was carried out through assessment of prevailing plans, acts, rules and regulations for sustainable land management. If the government does not take immediate necessary steps to conserve or protection, and if the changes of unplanned land use continues, in near future Dhaka could become a city of natural disasters.

**Abstract: 11220**

**EFFECT OF ELEVATED TEMPERATURE AND CO<sub>2</sub> ON YIELD AND NUTRITIONAL QUALITY OF TOMATO (*SOLANUM LYCOPERSICUM*)**

**N. R. Das<sup>1\*</sup>, A. Chaudhary<sup>1</sup>, S. D. Singh<sup>1</sup> and P. Saha<sup>2</sup>**

<sup>1</sup>Division of Environmental Sciences, <sup>2</sup>Division of Vegetable Science, Indian Agricultural Research Institute (IARI), Pusa, New Delhi-110012, India

\*E-mail: soilnami@yahoo.co.in

Tomato (*Solanum lycopersicum*) is the most important vegetable grown in India. Temperature and CO<sub>2</sub> are crucial environmental factors influencing plant growth, yield and other quality characters. The present experiment was conducted in controlled environmental condition of National Phytotron Facility, Indian Agricultural Research Institute (IARI), Pusa, New Delhi, India to study the effect of elevated CO<sub>2</sub> (600 ppm) and temperature on the changes in the yield and nutritional quality in tomato. Tomato variety, Pusa Ruby was grown at six different growth condition (T<sub>1</sub>: 24°C + ambient CO<sub>2</sub>; T<sub>2</sub>: 26°C + ambient CO<sub>2</sub>; T<sub>3</sub>: 26°C+ 600 ppm CO<sub>2</sub>; T<sub>4</sub>: 28°C + ambient CO<sub>2</sub>; T<sub>5</sub>: 28°C+ 600 CO<sub>2</sub>; T<sub>6</sub>:30°C+ambient CO<sub>2</sub>). Based on the observations on yield and quality parameters there was significant difference between the growth condition in terms of yield and quality characters. Maximum plant height (98.7 cm), number of fruits/plant (24.8), yield/plant (858.4 g) was found in T<sub>1</sub> (24°C + ambient CO<sub>2</sub>) where as maximum fruit length (4.15 cm) and fruit diameter (5.32 cm) was found in T<sub>3</sub> (26°C+ 600 ppm CO<sub>2</sub>). With the increase in temperature there was reduction in yield/plant and the lowest yield/plant (230.6 g) found in T<sub>6</sub> (30°C+ambient CO<sub>2</sub>). There was a tendency towards small parthenocarpic fruits at high (28°C) temperature regime along with ambient CO<sub>2</sub> condition resulted in low fruit yields where as this phenomenon was recovered under elevated CO<sub>2</sub> with 28°C. The combined effect of elevated CO<sub>2</sub> and temperature also influenced the quality characteristics of tomato. Maximum ascorbic acid (26.37 g/100g), TSS (4.58%) was found in T<sub>3</sub> (26°C+ 600 ppm CO<sub>2</sub>) where as lowest pH (3.48) was found in T<sub>1</sub> (24°C + ambient CO<sub>2</sub>). Temperature and CO<sub>2</sub> also affected the dry matter content giving highest dry matter (43.2%) in T<sub>3</sub> (26°C+ 600 ppm CO<sub>2</sub>) where as lowest (19.8%) was found in T<sub>6</sub> (30°C+ambient CO<sub>2</sub>). So from this study it is concluded that high temperature

had a strong negative influence on the normal growth and quality of tomato. Under elevated temperature with ambient CO<sub>2</sub> there was decrease in growth, yield and quality of tomato. Besides, plants enriched with CO<sub>2</sub> showed a significant increase in quality characters and dry matter up to a certain temperature limit (26°C) and then the quality started decreasing from 28°C with both ambient and elevated CO<sub>2</sub> level.

**Abstract: 11236**

**VULNERABILITY TO CLIMATE CHANGE INDUCED CYCLONE AND STORM SURGE IN COASTAL BANGLADESH: WHAT DETERMINES POST-CYCLONE HOUSEHOLD FOOD INSECURITY?**

**Shitangsu K Paul, Jayant K Routray and Shafiul Alam**

Regional and Rural Development Planning, Asian Institute of Technology (AIT), Thailand,  
Geography and Env. Studies, Rajshahi University, Bangladesh  
E-mail: shitangsuk@yahoo.com, routray@ait.ac.th, shafiul\_gis@yahoo.com

Since early 1980s food security has become a global concern and encompasses food availability, access and utilization. Food insecurity arises when food system fall under stress and such stressor (perturbator) can be the climate change induced cyclone and storm surge. In this study, we examined the recurrent damages of cyclone and induced surge in coastal Bangladesh, and identified the role of damage, livelihood capitals, socio-demographic variables and household coping measures for achieving food security in terms of per day calorie consumption. The study was conducted through questionnaire survey at household level with 331 out of 778 households in the central coast of Bangladesh. The study finds that 25.98 percent of sampled households are hardcore food insecure and 19.34 percent are absolutely food insecure in terms of the consumption of 1805 Kcal and 2122 Kcal per day respectively. The multiple regression analysis revealed that different socio-economic and demographic variables, livelihood capitals and different coping strategies are the significant predictors of post cyclone food insecurity. Hence, we argue that cyclones and storm surges are the main impediments of coastal Bangladesh while livelihood capitals, household demography and post cyclone coping strategies plays vital role to achieve food security.

**Abstract: 11238**

**TRENDS IN MAXIMUM TEMPERATURE AND ITS IMPACT ON THUNDERSTORM FREQUENCY DURING THE PRE-MONSOON SEASON IN BANGLADESH**

**Samarendra Karmakar and Md. Abdul Mannan**

Bangladesh Meteorological Department Agargaon, Dhaka, Bangladesh  
E-mail: mannan\_u2003@yahoo.co.in

Attempts have been made to study the trends in monthly and seasonal mean maximum temperature over Bangladesh during the pre-monsoon season using the data of the period 1961-

2008. It has been found that the monthly and seasonal mean maximum temperature have almost maximum decreasing trends at Rangpur during the period 1961-2008. Trends of monthly and seasonal mean maximum temperature are increasing at most stations of Bangladesh, and the trends are all positive in May during the pre-monsoon season of 1980-2008. The country-averaged seasonal maximum temperature over Bangladesh during the pre-monsoon season has increasing trend at the rate of 1.87°C/100 years during the period 1980-2008. The trends of monthly and seasonal mean maximum temperatures are maximum negative over the northwestern Bangladesh. Attempts have also been made to study the trends in monthly and seasonal frequency of thunderstorms over Bangladesh during the pre-monsoon season by using the data of the period 1980-2008. It has been found that the monthly and seasonal thunderstorm frequency have decreasing trends in Bangladesh during the pre-monsoon season. The country-averaged seasonal thunderstorm frequency during the pre-monsoon season has also decreasing trends in Bangladesh at a rate of -1.196/10years. The maximum decreasing trends lie over the northeastern part of Bangladesh during the pre-monsoon season of 1980-2008.

Correlation between monthly and seasonal mean maximum temperatures with monthly and seasonal thunderstorm frequency has been made using the data of 1980-2008. The monthly and seasonal mean maximum temperatures are found to be negatively correlated with the monthly and seasonal frequency of thunderstorms respectively and most of the correlation coefficients are statistically significant at 100% or 95% level. This means that the monthly and seasonal frequency of thunderstorms during the pre-monsoon season in Bangladesh will decrease with the increase of monthly and seasonal mean maximum temperatures. The correlation co-efficient of country-averaged seasonal mean maximum temperature and the seasonal thunderstorm frequency during the pre-monsoon season of 1980-2008 has been found to be -0.86174, which is statistically significant at 100% level.

**Abstract: 11246**

**ASSESSING ADAPTATION TO GENDER VULNERABILITIES DUE TO NATURAL DISASTER - A STUDY ON SOUTH WEST COASTAL BANGLADESH**

**Md. Mujibor Rahman, Md. Abdus Salam and Mahmudul Islam \***

Environmental Science Discipline, Khulna University, Khulna- 9208, \*Learning and Development Specialist, UNDP, CDMP, Dhaka 1212, Bangladesh  
E-mail: mujibku@gmail.com

Bangladesh has recently experienced a number of high-profile disasters, including devastating cyclones and tidal surges and floods. To identify the vulnerability, the southwest coastal Bangladesh is selected as a research area where high vulnerability to natural disaster is due to its low lying deltaic floodplain topography. Koyra is one of the coastal Upazila of Khulna district and it is typically vulnerable to cyclone and tidal surges, flood, salinity intrusion, heavy rainfall, River bank erosion etc. The research mainly focuses on adaptation options of Gender Vulnerabilities to Natural Disaster. The vulnerability assessment is based on questionnaire survey and demographic data analysis. The research revealed that various climatic events adversely affect the people of the selected community. People of the study area are fearful about the disaster and they ranked the cyclone and tidal surge as the most devastating disaster. About 100 % of total respondents supported cyclone and tidal surges as a number one ranking of

problem. Women are often the most vulnerable to the different impacts of climate change and natural disaster. Among women of different age group, the age group above 56 years women are severely vulnerable where as women of age group 46 to 55 years are highly, women of age group 36 to 45 years are moderately and women of age group 20 to 35 years are slightly vulnerable with other age group of women except pregnant women. Pregnant women are severely vulnerable for all kinds of natural disaster. By analyzing questionnaire survey and demographic data it is observed that women of Dakshin Bedkashi union is the most vulnerable whereas women of Koyra, Bangali and Maharajpur unions are moderately and women of Amadi union is slightly vulnerable. Local people are practicing various types of adaptation strategies including take shelter on high road and embankment, prepare elevated platform, migration, and forestation, and take loan to maintain livelihood and some other adaptation strategies. People of the study area have some special recommendation and demands to the government and non-government organizations. On the other hand, government and non-government organizations should take special care and initiatives to the Koyra upazila village community for their better adaption.

**Abstract: 11247**

**STRATEGIC ENVIRONMENTAL ASSESSMENT (SEA) ON CLIMATE CHANGE  
ADAPTATION AND DISASTER RISK REDUCTION PLANS IN KURIGRAM  
DISRTICT, BANGLADESH**

**Md. Mujibor Rahman, Md. Nazmul Hoque Sumon and Mahmudul Islam\***

Environmental Science Discipline, Khulna University, Khulna- 9208, Bangladesh

\*Learning and Development Specialist, UNDP, CDMP, Dhaka 1212, Bangladesh

E-mail: mujibku@gmail.com

Strategic Environmental Assessment is becoming an important tool to assess the probable future impacts of development policies, plans and programmes. In the context mentioned above, SEA is applied for assessing the climate change adaptation and disaster risk reduction related plans and programmes with an understanding of the current and future impacts of climate change and climatic hazards and related plans and programmes. This study is an effort to analyze the existing and future scenario of environment and society for formulating CCA and DRR plans and programmes on Kurigram district that was conducted through PRA tools, expert judgment and literature review. The northwest region is characterized by high temperature and low rainfall compared to average condition of Bangladesh which is severe in Kurigram district. Due to climate change the distribution of rainfall and its intensity is changing which is resulting in increased flooding and river erosion. The region is primarily prone to drought which is likely to become more frequent and intense along with horizontal expansion due to climate change. From the study, this was revealed that 63% of the respondents assume the severely affected natural disasters as an outcome of climate change. Deforestation, physiographic condition and the mighty Brahmaputra- Jamuna have also a great influence behind such type of disasters. Then flood associated river bank erosion may increase by around 20% in future which is devastating. In these contexts in future, total cultivable land will shrink and settlement area will increase; and hence there will be more frequent and severe disaster. Therefore, shortage of food and

employment will worsen and migration is most likely to intensify. Domestic violence or violence against women and children might increase due to social unrest. Under this changing environment, social cohesion and bondings may collapse and some livelihood group may go at a stake which was evident in case of fishermen in that region. According to some respondents (30%), sandy structure of the soil has made the region more erosion prone and some respondents (45%) opined that upstream intervention is responsible for bank erosion. Drought is an another considerable disaster there for which climatic variability like extreme temperature (according to 42%) and less precipitation (30%) are responsible along with groundwater lowering for over irrigational practices which was evident in the report of FAP 2. On the other hand, Flood Control and erosion protection embankment along the right and left side of the Brahmaputra, Teesta and Dudh kumar rivers have several negative environmental impacts like losing of critical ecosystem, losing of capture fishes, groundwater lowering, dried up of small rivers and reservoirs etc. Dredging was found as the best option from FGD (30%) for increasing the conveyance of the river and thus decreasing flood and erosion disasters. For sustainable management of climate change impact and disaster risk, there is needed an interdisciplinary approach in policy making and indigenous knowledge and community participation should be incorporated in policy making and policy implementation.

**Abstract: 11248**

## **IMPACT OF AILA ON AGRICULTURE AND LIVELIHOOD IN THE SOUTHWESTERN COASTAL REGION OF BANGLADESH**

**Md. Mujibor Rahman, Rehana Parvin and Md Ashraful Alam\***

Environmental Science Discipline, Khulna University, Khulna-9208, Bangladesh

\* Urban and Rural Planning Discipline, Khulna University, Khulna-9208, Bangladesh

E-mail: mujibku@gmail.com, [rehanaku.es06@yahoo.com](mailto:rehanaku.es06@yahoo.com)

The main purpose of the study was to assess the impact of aila on agriculture and livelihood. Besides, the problems were identified as confronted by the aila affected people during and after aila. Data on these issues were collected from aila affected randomly selected 100 household heads of three affected villages of Shyamnagar upazila of Satkhira district. Data were collected from the respondents through interview method using an interview schedule during 27 October to 26 November 2009. About half of the respondents were educated up to primary level (48%) and had medium sized family (48%), two fifth (42%) of them were crop farmers. A remarkable damage was observed in case of rice (BDT 55,385.20 per family) and the yield reduction due to aila was 2.47 ton. The extent of damage was highest in case of potato (BDT 1393.62 per family) while it was least in case of lal sak (BDT 30.48 per family). The highest damaged by aila was observed in case of fruit trees (91.81%) while it was least in case of wood trees (8.19%). On the basis of financial estimate the extent of damage of livestock was 93.56% (i.e. BDT 560250) followed by poultry 6.44% (i.e. BDT 38560). The highest extent of damage was observed in case of shrimp gher (6742000 taka i.e. 97.51%) while it was least in case of fish pond (172099 taka i.e. 2.49%). From financial consideration, the highest damage was observed in

case of house (53.55%) followed by furniture (15.69%), tools (12.37%), cloth (7.46%), ornament (3.32%) and others. Most of the respondents (97%) family members were affected by scabies followed by diarrhea (90%), fever (88%), dysentery (86%) and vomiting (19%). Aila affected sanitation system as a result the number of kacha latrin increased (25%). Maximum recreational media such as radio, TV were damaged by aila. Majority of the respondents (53%) fall in medium income group before aila. After aila it was observed that the majority (65%) of the respondents belonged to low income group. Most of the respondents (98%) were involved in sundarban related profession before aila for their livelihood. But after aila the dependence on sundarban related livelihood means decreased. During aila extreme water stream was most severe problem while lack of medical facility was less severe. After aila the most severe problem was stagnant of water while damage of educational institute was less severe.

**Abstract: 11209**

## FOOD TOXICANT AND FOOD ADULTERATION SCENARIO IN BANGLADESH

**Md. Golam Mustofa, Md. Sarwar Jahan and Md. Moniruzzaman Sarker\***

Institute of Environmental Science, University of Rajshahi, Bangladesh. \*Department of Zoology,  
University of Rajshahi, Bangladesh  
E-mail: sarkerphd@yahoo.com

The study was carried out to examine the toxic and adulterated food and a survey was conducted to assess the health hazards in human life. Laboratory examination and survey were used to assess the food safety scenario in the country during the period of 3 (three) years (2006-2008). Findings of eight renowned laboratories were evaluated and discussed. A survey was carried out on food toxicants and adulterant's usage, user and consumer's perception and related health hazards covering several locations of Dhaka, Rajshahi City Corporation and Kathiadi Upazilla of Kishoreganj District. Farmers, Street vended food sellers, Consumers of street food, concerned Scientists and Policy makers were interviewed using an objective oriented questionnaire. Wheat product (Atta, Moida) were analyzed in Food Toxicology Laboratory, IFST, BCSIR, Dhaka for determination of aflatoxin and these items were analyzed again in Industrial Physics Division Lab, BCSIR, Dhaka by Scanning Electron Microscope (SEM) with Energy Dispersive X-ray Microanalysis (Semi-quantitative) for heavy metal and toxic elements determination. Some other food items like- Chanachur, Chips, Noodles, White bread, Soya bean oil, Mustard oil, Pickle, Sauce and Fruit juice were also analyzed in BSTI laboratory for the quantification of adulterant and toxic elements. Adulteration of Fish with formalin, Vegetables and Fruits with copper sulphate, Calcium Carbide were also examined in the Institute of Food Science and Technology (IFST), BCSIR, Dhaka.

Laboratory findings led to assume that around 50% of food articles either adulterated or contaminated. The percentages of the street vended food consumers are higher in the city areas ( Dhaka and Rajshahi) than that in the Kathiadi upazila, as 50% of the respondents of Kathiadi never eaten street vended food while those are 40% and 41.66% in Dhaka and Rajshahi

respectively. 50% respondents of Kathiadi upazila and Rajshahi City never fell ill by food borne diseases while it was 40% for the respondents of Dhaka. Among different types of food borne diseases, diarrhoea was the most frequent in all the locations. All the quantities were above MRL and presence of aflatoxins B1 and B2 were further confirmed too by the LC/MS/MS analysis. Among the tested samples, 25% Chanachur, 50% Chips, 50% Noodles, 50% White Bread, 75% Mustard oil, 75% Soyabean oil, 50% Pickle (Mango, in Mustard Oil), 50% Sauce and 50% Fruit Juice (Sweeten Mango Juice) were fit for human consumption. Around 100 samples of fish were tested by the formalin detection kit from Dhaka City area, of which ten samples were found to be adulterated with formalin. From the results of the present study it was clear that, as cooking or washing had no impact on reducing the quantity of formalin, if any one consume these fishes, s/he would have no chance to avoid formalin consumption. At present consumers of Bangladesh are facing dangerous problems in food purchase or consumption and the general people do not know what they are eating, adulterated or contaminated or safe food.

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## Acknowledgements

We thankfully acknowledge the following organizations for their contributions and supports to our seminar:

- ❖ University of Rajshahi, Rajshahi
- ❖ University Grants Commission of Bangladesh
- ❖ CDMP (Comprehensive Disaster Management Programme)
- ❖ IBBL (Islami Bank Bangladesh Limited)
- ❖ Agrani Bank Limited
- ❖ Postal Academy, Rajshahi
- ❖ Barendra Multipurpose Development Authority (BMDA)
- ❖ Pran-RFL Group
- ❖ Akij Food and Beverage Ltd.