



IUBAT—International University of Business Agriculture and Technology

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Proceedings of the National Seminar on Food Security and Ecosystem Management in COVID-19 held on 19 November 2020, Dhaka

Organized by IUBAT Institute of SDG Studies (IISS) and Regional Centre of Expertise (RCE) Greater Dhaka, Bangladesh.

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Abstract

A national seminar on “Food Security and Ecosystem Management in COVID-19” was held on 19 November 2020, virtually. The seminar was organized by the IUBAT Institute of SDG Studies (IISS) and Regional Centre of Expertise (RCE) Greater Dhaka, International University of Business Agriculture and Technology, Dhaka, Bangladesh and it was participated by 131 academicians, professionals, researchers and high officials from the Bangladesh Government, representatives from FAO and Regional Centre of Expertise (RCE) and foreign delegates. Four papers were presented, and 16 dignitaries participated in the discussion. It was a four-hour-long seminar, had a good discussion on the topic mainly highlighting the importance of healthy and functional ecosystems in ensuring food and nutrient security. They expressed their concern about the highly deleterious ecosystems and made recommendations to improve the situation at the earliest. The important comments and suggestions are recorded and compiled in the proceedings with policy recommendations for the policy makers of the government.

Preamble

Food is the basic requirement of human beings and all other living organisms in the world. It is the media for energy that comes from the ultimate source, the sun. The energy passes through the food chain and food web in the ecosystems involving biotic and abiotic factors in the form of food and nutrient consumption and recycling. Therefore, to secure quality food, a healthy and functional ecosystem is of utmost essential. Unfortunately, the importance of a functional and healthy ecosystem is seldom realized and so global hunger persists, as that has not been properly addressed. Despite technological advancement, hundreds of million people are hungry throughout the world and billions are suffering from malnutrition, obesity and diseases. Disasters, natural calamities, and population growth are being blamed for hunger and now global warming and climate change are greatly considered for food insecurity. But the food crisis was there in the early ages, in the near past, and at present. In the present COVID-19 pandemic, the

situation has aggravated and more people are starving and will starve in the future. The targeted Zero Hunger by 2030 for achieving Sustainable Development Goals (SDGs) has become uncertain.

Alongside, the ecosystems, the food producers are disturbed, invaded, encroached and damaged continuously, knowingly or unknowingly. Thus, food and nutrient security has become more complicated and more are being added to the hunger list. However, the UN Decade on Ecosystem Restoration, running from 2021 through 2030, aims to halt the degradation of ecosystems and restore them to achieve global goals. UN Member States decided to implement the Decade on Ecosystem Restoration to realize these benefits and to ensure that healthy ecosystems play a critical role towards achieving the SDGs by 2030. This UN Decade will inspire and support governments, UN agencies, NGOs, civil societies, children and youths, private sector companies, indigenous peoples, farmers, women's groups, local communities and individuals globally to collaborate and develop the appropriate skillsets for catalyzing and successfully implementing restoration initiatives across the world. Although, the UN Decade ends in 2030, it aims to create a platform for societies globally to put their relationships with nature on a new trajectory for centuries to come.

Considering the importance, IUBAT Institute of SDG Studies (IISS) and Regional Centre of Expertise (RCE) Greater Dhaka have organized the seminar inviting the government's high officials from SDG Affairs Prime Minister's Office, Department of Environment (DoE), Bangladesh Climate Change Trust (BCCT) and Planning Commission; representative from the United Nations Food and Agriculture Organization (FAO), different national and international experts to put their views on this critical issue of food security and ecosystem management. Professor Dr. Abdur Rab, Vice-Chancellor of IUBAT presided over the four-hour long seminar, Professor Selina Nargis, Chairperson of RCE Greater Dhaka welcomed the participants and briefly described about the two-decades long sustainability program and green campus of IUBAT; Professor Dr. Mohammed Aaur Rahman, the Director of IISS presented the keynote paper: 'Ecosystem Management is the Key to Reduce Climate Impacts and Food Security'.

During the seminar, speakers and other paper presenters discussed in detail the management of food security during the pandemic in order to sustain Bangladesh's success in agriculture. Action plans need to be drawn to meet the food and nutrition needs of the growing population. As an agriculture-based nation, Bangladesh has still experienced food shortages during the pandemic, highlighting the need to strengthen coordination between farming and other social, economic and environmental aspects. Sustainable agriculture needs to be planned and implemented in a resource-efficient way that ensures recycling, socially conducive, commercially competitive and environment-friendly. The seminar brought together policymakers responsible for integrating ecosystem management and effective ecosystem governance, and academia, to address the social aspects of the ecosystem connections to food security by strengthening local organizations and gender equality. The seminar will help to promote a global movement focusing on ecosystem restoration; developing legislative and policy frameworks to incentivize restoration; developing

innovative financing mechanisms to fund operations on the ground; detailing a values-based imperative to conserve, restore and care for nature; undertaking social and natural science research on restoration in terrestrial, freshwater, estuarine as well as marine environments; monitoring global progress on restoration, and building the technical capacity of restoration practitioners globally to secure food and nutrients for all.

Organizer, Place, Date and Participants

The national seminar was organized by the IUBAT Institute of SDG Studies (IISS) and Regional Centre of Expertise (RCE) Greater Dhaka, patronne: International University of Business Agriculture and Technology, Uttara Model Town, Dhaka 1230, Bangladesh on 19 November 2020 from 18:30 to 22:30 Bangladesh time via electronic media <https://bdren.zoom.us/j/67296979777>. There were 20 speakers and discussants, 131 direct participants and many connected indirectly through Facebook live. There was a number of news media coverage both local and international.

Presentations and Discussion

Professor Mohammed Ataur Rahman in his keynote paper emphasized on the importance of healthy and functional ecosystems to ensure the food and nutrient security. He explained the productivity of the earth ecosystems; their criteria for production in different regions which are the basis for distribution of global food and population. Human intervention has changed most of the ecosystems; quick and unplanned urbanization, industrialization, infrastructure, dams and agricultural expansion etc. are the important. These resulted in the obstruction of hydrological cycle, changes of water flows, landscapes and pollution and thus, hampered the productivity and nutrient recycling in the ecosystems. He compared the increment of food production and population worldwide since 2000 to 2018 and claimed that average food production increased by 50% against population increment which is only 24% but under-nourished population remained unchanged rather malnutrition related obesity and diabetic population alarmingly increased which is more than 2.5 billion. Further in the COVID-19 situation, 135-235 million hungry people are added and the hunger will be increased. Professor Rahman claimed that food production is not critical but the nutrients and distribution of food are important in the present world for which nutrient recycling in the ecosystems can ensure food security.

In the keynote paper, he drew the attention highlighting the present situation of the polluted and damaged river ecosystems around Dhaka city, economic, social and environmental losses incurring every year. The physiochemical and microbiological parameters from different sources were shown for causing the harmful situation of the river waters: not usable, recyclable and loss of biomass nutrients with the contaminated water. The loss of services accounts for water: 1,149,750 million liters value BDT 45,990 million; fish: 23,885.6 tons value in BDT 4,777 million and biomass-nutrients 1,716,960 tons worth BDT 8,585 million, every year. Besides these, other services like drainage of water are seriously obstructed causing floods and waterlogging damage infrastructure; loss of urban and peri-urban crops; transmission of

waterborne diseases and loss of biodiversity. He also explained the fate of food: biomass and nutrients in the urban centers. The foods are coming from the agricultural fields, farms, forests and seas consumed by the urban people; the wastes are remained in the latrines or septic tanks years together, overflows and ultimately pollute rivers and the kitchen refusals are also dumped in the wetlands for landfilling or drain to the polluted rivers.

The situation of field or cropland ecosystems is worse; practicing high input-based agriculture with hybrids and GMOs, chemical fertilizers and pesticides to maximize production and yield which are again going to the remote consumer places mainly urban city centers directly or via industries and the wastes or the refusals are ultimately dumped to pollute rivers without recycling to their origin and the fields are deprived of necessary nutrients. Thus, the cropland ecosystems are losing huge biodiversity *viz.* microbes, earthworms, frogs, insects, snails, snakes, rodents, owls, birds etc. and resulting quick soil degradation.

Professor Rahman pointed out the importance of ecosystems for food, biomass recycling, water and sanitation, biodiversity, climate change in SDGs 2030, specifically in SDG 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture, SDG 3 Ensure healthy lives and promote well-being for all at all ages, SDG 6 Ensure availability and sustainable management of water and sanitation for all, SDG 13 Climate Action: Take urgent action to combat climate change and its impacts, SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development and SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss. FAO has also emphasized that sustainable agriculture must nurture healthy ecosystems and support the sustainable management of land, water and natural resources, while ensuring world food security. It clearly stated that waste is a human concept – not exists in natural ecosystems. By imitating natural ecosystems, agroecological practices support biological processes by recycling of nutrients, biomass and water within production systems, thereby increasing resource-use efficiency and minimizing waste and pollution. More recycling means agricultural production with lower economic and environmental costs.

In the keynote, food insecurity and climate change were discussed; climate is the basis for crop production, climate determines crop adaptation whereas local weather determines the crop development and productivity. Photosynthesis responsible for crop productivity, depends on light, temperature, CO₂ and water. Climate change impacts on food production, availability, stability and utilization. It changes agro-ecological conditions, declines food production and increase variability of food supply, indices show warming and changes regional rainfall patterns, increases weather extremes *viz.* floods, drought, cyclones. Global warming and impacts of climate change: global temperature rose in last century: 1.14°C and ocean temperature increased 0.33°C since 1969. Shrinking ice sheet from Greenland 279 billion ton/year (1993-2019), antarctica 148 billion tons/year and glacial retreat observed almost in all mountains; decreased snow cover and sea level rose in last century 20 cm; ocean acidification increased by 30%.

Moreover, extreme events: heat wave, drought, flood, cyclone etc. are becoming more frequent. Forest fire mainly plantation forests of Australia, Europe and California are happening every year. Tremendous impacts of climate change on forest ecosystems as the trees do not allow rapid adaptation to environmental changes which affects growth and development, outbreaks pests and diseases; increases storms, fires, land sliding and erosion.

Agricultural expansion has been destroying forests, wetlands and landscapes increasing greenhouse gas emission, declining biodiversity due to biased and selective cropping and animal farming. It degraded all regulatory services of the ecosystems like air quality, water purification, carbon storage and soil erosion control. Agriculture destroys climatic adaptation by forced hybridization and GMOs cause loss of immunity. High chemical inputs affect microflora, food chain and food web. Moreover, irrigation-based agriculture destroys soil phases, flora and fauna.

Professor Rahman also pointed about the vulnerability of the most productive coastal ecosystem where one-third of population of Bangladesh are living. Coastal zone is the transition between land and sea; its estuaries, marshes, lagoons and mangroves play a key role in maintaining hydrological balance, filtering water of pollutants, providing shelterbelt and habitat for birds, fish, mollusks, crustaceans, and ecologically and commercially important organisms. It has critically been threatened due to human intervention, pollution and squeezing of the mangroves. Now, coastal flooding and inundation, salinity intrusion, frequent cyclonic storms and tidal surges due to deforestation of mangroves, are happening more in numbers. Pollution from the ports and shipbreaking industries, chemical and oil spills; huge accumulation of plastics and polythene causing loss of huge biodiversity there. Moreover, in the wet monsoon noor very little agriculture is practiced due to frequent and prolonged coastal flooding.

In the keynote paper, vulnerability of marine ecosystem brought under notice that climate variability affecting severe storm behavior and ocean wave; ocean and atmospheric temperature change affecting species distribution impacting marine biodiversity; carbon dioxide uptake in the ocean increases ocean acidity and reduces the saturation state of carbonate minerals, essential for shell and skeletal formation of many coastal species; changes in freshwater input altering coastal ocean salinity due to melting of arctic ices. Recent discovery of a Dead Zone in the Bay of Bengal of about 60,000 sq km where oxygen level is less than 0.032 mg/l that cannot support life and it is a great alarm to the availability of marine foods.

To secure food, the need for management of healthy and functional ecosystems has been emphasized in the keynote paper arguing the following points:

1. Ecosystem degradation affecting food production and availability of clean water, thus threatening human health, livelihoods and ultimately affecting societal stability.
2. Ecosystem degradation increasing vulnerability to the consequences of natural disasters and climate change impacts.
3. Therefore, ecosystem management can be defined as an integrated process to conserve and improve ecosystem health sustaining ecosystem services for human well-beings.

4. Healthy ecosystems provide opportunities for sustainable economic prosperity and ensure food security.
5. Providing defense against the negative effects of climate change through human adaptation and behavioral change, as opposed to a continuation of degradation.

In the keynote speech, the following Ecosystem-based Adaptation (EbA) practices are proposed:

- Restoration of Hydrological Cycle: Water table and Watershed Management
- Restoring Forests and Wetlands
- Biodiversity Conservation
- Respecting Climatic Adaptation for Saving Varieties and Species
- Traditional Flood Plain Management
- Rural Home Centered Aggregated Farming
- Agroforestry
- Agriculture in Adverse Situation
- Urban Greenery: Parks, Woodlands, Gardens
- Urban Agriculture: Water and Waste Management
- Climate Smart Agriculture
- Mitigating and Adapting Climate Change

He emphasized on traditional floodplain management and on rural home-centered aggregated farming (RHCAF) where a home should have a pond, homestead forest and houses for dwelling. A Home is the activity center; safer and healthier with homestead cropping *viz.* fruits, vegetables, spices, bamboos and fences. There should be farming with cattle, goat, chicken, pigeon, ducks, bees and pets and domestic animals like dog, cat, mongoose, Myna etc.; pisciculture; wild plants and animals; processing, preservation, reuse and recycling in the home. To reduce rural urban migration, RHCAF should be prioritized with family and social farming concept. Therefore, a well-planned rural infrastructure development is highly essential.

Dr. M. Rehan Dastagir, Deputy Director, IISS presented a paper on “Decadal change of soil fertility in Bangladesh: modeling survey data” he examined the present soil fertility status in Bangladesh and showed that the soil fertility has changed over the decades but there was no quantified model about what type of changes happened over the decades. He urged that soil is the most important natural resource and has connection with six SDGs (SDG-2,3,6,11,12,13). Intensive agriculture has been practicing in the country with the use of fertilizer, pesticides, Hybrid crops, monoculture etc. are deteriorating soil environment. There is a need for assessment of the present fertility status of the soil. Soil Resource Development Institute (SRDI) of Bangladesh has done several countrywide soil surveys along the decades from the 1990's. However, no systematic model was applied by the institute to compare the data. The authors compared data following novel data science approaches in some Agro-Ecological Zones of the

country. A significant change in soil fertility status was found in crop fields along with a change in nutrient interactions of macro or micro nutrients.

From the study, he recommended the following points:

1. The nationwide decade long soil survey of SRDI needs appropriate quantitative models to study in the light of data science approach;
2. Data Science is the present trend of agronomic spatial analysis of natural resources that needs to be considered;
3. For sustainable soil management, soil nutrient interaction should be taken into consideration that was not considered in the earlier surveys.
4. It has also recommended for the research on legacy or fixed soil phosphorus to replace an extra addition of soil fertilizers and sustainable use of soil residual fertilizers.

Prof. Dr. Mihir Kumar Roy, Dean, City University told that the COVID-19 is now a global problem and it has affected people of both developed and developing countries all over the world. From the starting of the COVID-19 infection, Bangladesh government gradually started taking programs during the last eight months. The issues of the public problem created two challenges i.e., one is the health risk and another is the livelihood risk. It had also created challenges in implementing SDG Goals of 2 (end hunger), 13 (climate change), 14 (life below water) & 15 (Life in land). The update of health risk up to 19 November, 2020 in The World as well as Bangladesh context were affected 5.60 crore, recovered 3.90 crore, death 13.45 lakhs (world context) & affected 4.38 Lakh, recovered 3.58 lakh, death 6.275 thousand (Bangladesh context). The livelihood context was very dismal i.e., nearly 7 crore people went on poverty line because of Covid-19 effects.

So as part of the definitions of food security, it has four components such as food availability, food access, food utilization and food stability. Bangladesh is very much fortunate to have enough food security in the country especially Bangladesh is the third in the world in fish production, fourth in rice production, fifth in goat meat production, seventh in mango production. Bangladesh has started leather export and it is the largest jute exporting country. We are in a good position regarding food security but if we go to the market, it is found that the prices of commodities have jumped especially of rice, vegetables and meat. The prices of food increased tremendously where we dream as a developing country by 2024 free from hunger by 2030 and 2041 as a developed country.

The Government has to overcome the situation now. This seminar is concentrated on the impact of publication on the food security and the ecosystem management. So, during the COVID problem in the last eight months, our observation is that the government is tremendously administered the mechanism to control the situation. Bangladesh is a disaster-prone country and we are tremendously facing hazards like river erosion and cyclones. Climate change increases the frequency of such events; it affected 34 to 48 percent people by waterlogging and 3.8 percent people by cyclones. Coal, oil and gas exploration have an impact, especially on fishing. It has

another impact on the marine environment especially in the fisheries sector. The toxic-related ship-making and breaking yards have an impact on our marine efficiency. We have to maintain a balance between the production of marine diversity and industrial activities. SDGs promote the sustainable use of terrestrial ecosystem and sustainability that needs to manage forests, rescue land degradation and save biodiversity. To address the COVID-19 disease, it is important to restore terrestrial ecosystems like forest wetlands and ecosystems in Bangladesh. It is recommended that ecosystem must be preserved at any cost for the sake of humanity and environment.

Dr. Sayma Akhter, Assistant Professor of IIS in her presentation entitled “Can Crop Wild Relatives Support Food and Nutrient Security? an experience from wild mango species”. Nearly two billion people have food insecurity, most of them from Asia and Africa and during the Corona pandemic; the number of hungry people is increasing. Food insecurity is also related to malnutrition and wild crop relatives can help in this context. Wild crop relatives are the wild cousin that we see in the market. They cross among themselves naturally and create new trades. Usually, the breeders make crossing with the domestic crops to get new varieties. Crop wild relatives are well resistant to pests and disease. They are highly tolerant to extreme weather conditions and contribute genes that can increase the yield, nutritional quality etc. There are so many other kinds of wild relatives available in the natural condition however, 81 crop wild relatives have been identified so far. In Bangladesh we have many crop wild relatives, *Mangifera sylvatica* (wild mango) is one of them which is known as Uriam locally. Its native range is Bangladesh, India, Nepal, China, Thailand, Myanmar and Cambodia. This wild mango is a multi-purpose tree species. It is considered as important food for the wildlife and human beings as well. These are very much rich in nutrition and good sources of medicine. Wild crop relatives are very much important for not only for food security but also securing our livelihood that can help to achieve sustainable development goal “zero hunger”.

Recommendations:

1. Wild fruits are rich in macro and micro nutrients so, more research is needed to explore true potential of many other wild crops available in Bangladesh.
2. Adding wild crops in plantation as commercial crop would be a good option to conserve them.
3. Promotion of wild crops as sources of alternative income will give livelihood security for the forest depended people.

Prof Amzad Hussain, Curtin University, Australia said that the lessons learned from COVID 19 that food security and ecosystem management should be done globally and locally. Food security and ecosystem management go hand in hand and exist in a synergistic relationship if food security is insecure or unsustainable. That means there is something wrong with the ecosystem and if conversely if ecosystem is healthy, we can assume that food security should prevail. About COVID-19, it is not in our current stock of literature on sustainable development with ecosystem management or food security because it has come later and it has just emerged last year or this year. Therefore, it can be said that it has emerged as an unknown phenomenon

which actually nobody ever seen before. The COVID-19 which has impacted on the whole world in part of in terms of its mortality capacity and damaging people's health in an immense way.

He added that so far there is no answer for medical solution, no scientific nor surgical even no technological fixes to address the corona pandemic; in this situation, the world is in confusion and everybody is trying to believe that it is sub-divine intervention of suffering from natural phenomenon against human aggression and towards exploitation of resource including the ecosystems. Ecosystems include the sunshine and free-flowing air on this earth or in nature. When an ecosystem or the nature is a living being like us, they also need some sort of cares everything what human needs because they are also living being in the ecosystem.

He added that the whole humanity is in trouble or when somebody is unkind to us, we want to take reference same as the case from this nature. Nature has the capacity to buy it back and divide back in terms of sort of floods droughts and diseases like malaria, cholera and other pandemics. However, as you know that things are limited and this is found almost in all scripture particularly in the Holy Quran it says several times that the natural resources are limited. When corruption appears with human, they take defense and talk to even so that people can understand that they are wrong and can turn back to their normal situation.

He claimed that COVID-19 has taught humanity many things particularly in terms of food habit and physical distancing, lockdown, hand washing and face marks, gloves etc. All these are not medical solution and these were actually known to people 1500 years ago by one of our prophets.

So these are very effective and fruitful and as corona is going to stay for a long time, these things should be included in our daily life. The world academia is calling this as the new global culture actually two things are included one is outer another is inner. The outer thing is modest lifestyle and simple dietary habits and physical work and spiritual and inner things. Spiritual exercises responsibility moral education etc. Food consumption and production is the route for sustainability of ecosystems as well as food security. Food security and ecosystem sustainability see from the health benefit of water rice that means the plant-based food is produced. In this way we produce food in two ways; one is plant waste or another is meat waste.

Bangladesh government found that “panta-bhat” is much more controversial part of just normal rice but soaked into water for some time when it is fermented. When it is fermented its sodium, iron, potassium everything are increased by many times. The unique thing is produced in generated in panta-bhat is a strengthening body immunity that is antibody which is most important for addressing corona. In meat or animal protein there is no antibody elements. So how food security is linked to the food habit and food consumption habit like panta-bhat and meat consumption? Meat consumption we need to feeding livestock and feeding livestock alone claims 70 percent of all agricultural land 70 percent of all water withdrawn and it also takes 10 times more energy than producing plant-based rice plant-based food. Because of the fossil fuel energy emissions there is a problem with climate change and global warming.

Md Monirul Islam, Joint Secretary, SDG affairs, Prime Minister Office said that the Bangladesh government is advancing towards Sustainable Development Goals from the Millennium Development Goals (MDGs) due to the fact that issues to sustainable development and institutional involvement were not addressed in the MDGs. The performance of the country in the MDGs was satisfactory though social, economic and environmental considerations were not categorical in MDGs. He claimed that the nation adopted its own strategy to work on SDGs and became a front runner from the beginning of 2016. This was the fortunate period to adopt SDGs in the seventh five-year plan. He added that the seminar theme on food security and ecosystem management is very relevant to implement SDGs in a populous country like Bangladesh through coordination of various ministries and added that any single SDG needs multi-ministry involvement of the government. He emphasized this need of investment in research and development from 0.3% GDP to 1%. SDG affairs, Prime Minister Office is now considering academia to be a key player in research and development through a whole society approach. The office is very interested in the policy brief from academia. Mr. Islam also encouraged to involve youth of the university in the process.

He recommended the following points:

1. There needs an investment in research and development from current 0.3% GDP to 1%.
2. SDG affairs, Prime Minister Office is now considering academia to be a key player in research and development through a whole society approach.
3. The office is very interested in seminar policy brief and contribution from university.
4. Involvement of youth of the university is necessary in the process.

Md. Ziaul Haque, Director, Department of Environment told that for food security emphasis should be given on the health of the ecosystem to restore it from continual degradation to sustain its productivity. He added that the ecosystem productivity is deteriorating due to application of pesticides, industrial heavy metals in water bodies and brick kilns. Brick kilns use fertile topsoil and deteriorating field ecosystem. He also told that the Department of Environment is taking policy to have all government activities and infrastructure use non-fire blocks in case of fire bricks by 2025.

He recommended the following points:

1. In considering food security, emphasis should be given on the health of the ecosystem to restore it from continual degradation and sustaining its productivity.
2. All government activities and infrastructure must use non-fire blocks in spite of fire bricks by 2025.

Dr. Nasir-Ud-Doula, Director, Bangladesh Climate Change Trust (BCCT) told that the food security represents availability of food to the citizens. Climate change is already affecting food security of the country through interrupting the availability of food, domestic supply, access to resources for producing food and growing energy demands. Bangladesh is one of the vulnerable countries in the world in terms of natural disasters i.e., floods, cyclones, droughts etc.

Bangladesh needs evidence-based technologies to tackle the challenges of climate changes. Poverty eradication and social well-being for all levels of the people is the vision of the government of Bangladesh can be achieved through adaptation and disaster risk reduction and low carbon development of Climate change management strategy. He claimed that the Bangladesh Climate Change Action Plan 2009 also addressed food security to ensure most vulnerable parts of the society: women and children. Vision 2021 of Bangladesh also addressed management of climate change as an integral part of sustainable development. According to IPCC prediction, climate change will also decline rice production 8% and wheat production 32% by 2050. Finding effective solutions of climate change action plans should be scientific and need based to get resilience on food security.

He recommended the following points:

1. Climate change has real threat on food security of the country through interrupting the availability of food, domestic supply, access to resources for producing food and growing energy demands.
2. Bangladesh needs evidence-based technologies to tackle the challenges of climate changes.
3. Finding effective solutions of climate change action plans should be scientific and need based to get resilience on food security.

Mr. Shimul Sen, Senior Assistant Chief, Planning Commission participated in the discussion and told that the 8th five-year plan started from July 2020 will keep the issues of SDGs. An SDG mapping is underway to know the role of who is doing what. A data analysis is given high priority to know the real progress and emphasized on data monitoring. Budget preparation will be done in the 8th five-year plan. In the next SDG action plan academia/universities will be included in the whole society approach that was left behind. A comprehensive emergency response plan is adopted to address health and socio-economic recovery measures in COVID-19. The pandemic undoubtedly affects the agenda 2030. Bangladesh is taking its own strategy to absorb the shock of COVID-19 in the next five-year plan. Food security and ecosystem management also gave priority in this plan. Localizing SDGs in Upazilais also under action plan. Finally, involving universities with government and suggestions from academia will be an open-door policy.

He recommended the following points:

1. The 8th five-year plan started from July 2020 has kept the issues of SDGs.
2. A SDG mapping is underway to know the role of who is doing what.
3. A data analysis is given high priority to know the real progress.
4. Data monitoring will be done also.

5. Budget preparation will be done in the 8th five-year plan.
6. In the next SDG action plan academia/universities will be included in the whole society approach that was left behind.
7. A comprehensive emergency response plan is adopted to address health and socio-economic recovery measures in COVID-19.
8. Bangladesh is taking its own strategy to absorb the shock of COVID-19 in the next five years plan.
9. Localizing SDGs in Upazilas is also under action plan.
10. Finally, involving universities with government and suggestions from academia will be an open-door policy.

Dr Kristofer Johnson from FAO, Bangladesh mentioned that northern region of Bangladesh suffered mostly from food insecurity than southern part due to the COVID-19 pandemic. Besides, northern regions' ability to have a healthy diet has decreased tremendously compared to southern region people. A recent study conducted by FAO found that price of Boro rice has increased significantly from 20 to 30% during this pandemic where labor and machinery scarcity was severe all over the country. To reduce these negative consequences, Bangladesh government has prepared an action plan. Midterm action plan includes increase in agro-production, promotion of organic fertilizers, improve marketing system, development of high-yielding varieties, improvement of agro-processing training and promotion of e-agriculture. Long-term action plan includes developing technologies to cope with climate change, improve irrigation efficiency, research, and development. Overall, he emphasized on sustainable agriculture practices such as adoption of agroecology to overcome this pandemic shock.

Dr Abdhesh Kumar Gangwar, Coordinator of RCE Srinagar and Asia Pacific Regional RCE Committee praised that out of 175 global RCEs, RCE greater Dhaka has been doing excellent work. He said that planet earth and its ecosystem is really gasping due to diversity loss, climate change, global warming and water shortages. The generation before us lived on this planet and lived in harmony with nature that they could pass plenty of the natural resources that we have been fortunate enough to inherit from our ancestors. The current generation has been good in terms of technology, information but not able to do justice to maintain sustainability. By 2050 the earth will be in terrible shape if we do not really take drastic measures. By 2100 the temperature rise, global warming and all the ecosystems that we have will be terribly deteriorated and not really worth living so that is the big question mark taking care of the planet earth ecosystem for our own lives as well as for the survival of our future generations. We have an ecological footprint that decides how we have been treating our planet earth. Our footprint has been increasing and the bio-capacity that the planet is able to meet our demands has been constantly decreasing. We have seen the soil is no longer productive. It has lost the organic content and biodiversity. So, earth planet is facing huge problems and we all need to sort out to

take care of our future. We have three major ecosystems: the terrestrial, freshwater and marine ecosystem-all these three major ecosystems meet our demands. However, they all are in very bad condition. In the case of the freshwater ecosystem, we see the loss of biodiversity; groundwater pollution; surface water pollution and shortage of freshwater. Countries and cities have been mapped where there is scarcity. At the global level, we need to take care of these ecosystems (terrestrial, freshwater, and marine).

Recommendations

1. Human resource management is the Key to sustainable economic growth:
Bangladesh needs to look at the population that it has to make it a resource. Currently, in India, Bangladesh, and many other countries of South Asia's population is not really an asset. It is a liability because they have not been able to give skills to the population. On the country, neighbor country China has done it, so that is the lesson has to learn from neighbors. Lessons from small countries like Taiwan, Hong Kong, Vietnam, and Singapore can be very profound.
2. Bangladesh needs to maintain soil fertility which will ensure food security:
Bangladesh is an agricultural country. Soil which is the basis of agriculture is really very poor in quality and fertility. It contains very poor organic matter, microbes that ultimately reduced water holding capacity, soil porosity. If we lose this top fertile soil, it will take ages to build it.
3. Bangladesh needs to focus on sustainable agriculture and aquaculture.
4. Eco-friendly tourism can be a great earning source of the country:
Earning from the tourism sector could be another example from Nepal, Bhutan, Sri Lanka, Thailand and Cambodia. Bangladesh has a variety of ecosystem, right from hill tracks to the plain lands; from coastal to marine; world's largest mangrove forest Sundarbans and so many to attract tourists. So, by simply managing ecosystems and then putting them for the world community and getting income out of it can protect ecosystems and then make income out of it.
5. Claiming climate fund from Developed world:
Bangladesh is very vulnerable to disaster. So, the country needs to focus on building a disaster-resilient community. Bangladesh doesn't contribute much to climate change so it must be compensated by the global climate change fund for not contributing to climate change but getting suffered so badly because of the impacts of climate change. So, focusing on agriculture is good but alternative livelihood sources are needed too if it wants to reduce pressure on agriculture.

Ms. Zuena Aziz, Principal Coordinator of SDG affairs, PMO, in her speech greeted all for organizing the seminar on “Food Security and Ecosystem Management” in COVID-19 in the “Mujib Year” that is committed to fulfil the dream of Bangabandhu to build “Sonar Bangla” which is realizing by the Prime Minister Sheikh Hasina. She told that, under the agenda 2030 to end poverty, protect the planet, to ensure peace and prosperity for all social economic and environmental challenges are targeted to be balanced in a manner that no one is left behind and reach the furthest behind first. To meet such resolutions and endeavors she emphasized the importance of this kind of conferences for academics and researchers and young minds of the

students participate in enhancing the idea of solution to different kinds of global problems particularly food security and equal system management.

She added that the papers those have been presented in this seminar and discussions on the issues would help the researcher to get ideas that will be useful in the national and global context. She said that the Prime Minister has instructed to integrate the targets of SDGs into development strategies. She also informed that the eighth five-year plan is in final stage, which will also cover all the targets of SDGs like the seventh five-year plan and are following the whole of society approach to implement the SDGs. She added that the ministries are aligned horizontal and vertical integration among the different actors of SDGs giving them the responsibilities. She is deeply concerned with COVID-19 pandemic which is taking lives spreading human sorrows and seriously disturbing people's livelihood and the prime minister is taking necessary action for which is focusing on lives and livelihood is showing positive sign in the economy and has announced different immediate, short- term and mid-term stimulus packages for financial year 2023 to 2024. For 2021, economic sectors the policy was to increasing government expenditure focusing employment creation, financial assistance package, increasing social security activities and increasing money supply to ensure food security. Special emphasis was given to enhanced agriculture production, mechanization of agricultural work, agricultural subsidies, agricultural refinancing scheme, and refinancing scheme for low-income farmers and small traders. The government has provided food assistance and digital financing aid to 5 million households who are needy and classified as poor people. Government has provided new homes for 600 climate refuses. In total four thousand four hundred nine families will get new homes by 2023. Apart from this, the disaster management department provided climate resilient houses to the people who are living in the coastal areas. Bangladesh is one of the most proactive developing nations that has considered the issue of climate change seriously and subsequently achieved success in developing nation level scientific expertise and government level actions. In conclusion, SDGs are all encompassing integrated and interdependent agenda therefore a strong and comprehensive platform like this seminar will create an opportunity for scholar's, researchers, practitioners' academics and students to explore exchange debate discuss and create a discourse for their own.

Professor Hamida Akhtar, Pro Vice Chancellor of IUBAT in her speech told that the seminar topic "Food Security and Ecosystem Management in the context of COVID-19" is very important issue for not only national but also global. She added that COVID-19 pandemic has really created a global health crisis and the long-term impact of the pandemic is predicted to reach far beyond today in a country like Bangladesh. A middle-income country with upward economic growth, it is essential to develop proper understanding of the present situation and come up with a recovery plan and made significant progress in poverty reduction over the last two decades. Its poverty dropped to 23.2 % in 2016 from 48.9 % in 2000 which helped improving the country's food security status and we all know that Bangladesh made remarkable progress in most of the four dimensions of food security (food availability, food access, food utilization and food stability). Unfortunately, with the advent of COVID-19 travel restrictions, lockdown and social

distancing measures etc. it caused a setback in the country's position although government always states that the country is well prepared for crisis. She emphasized for positive steps on the social aspects and to come up with certain positive steps. One of the greatest negative aspects is corruption in the marketing such as sudden price hike and non availability of food items in the market which make food insecurity.

Professor Hamida Akhter emphasized on COVID-19 that has not only created uncertainty but has opened opportunities for future strategic planning of strengthening food security. For post pandemic rebuilding program, the experiences of the affected should be a lesson. She also added that agriculture should be given foremost priority for rebuilding the future. Farmers are the basic elements of food security planning so their interests must never be gone unheard. It is necessary to build a “Farmer Consumer oriented Production Processing and Marketing System” to lead a comprehensive recovery and increase preparedness for dealing with food insecurity.

Professor Dr. Abdur Rab, the Vice-Chancellor of IUBAT in his presidential speech talked about the earlier famines in Bangladesh as well as in other parts of the world and described the importance of food security. Bangladesh is a small area of 147,570 square kilometers with a huge population of 170 million. A productive population that can enhance the economic growth of Bangladesh is a great challenge. These have become even more difficult in the face of climatic change. So, the issues that have been discussed in this national seminar should be brought together in an integrated form to find out what are the problems and challenges; how to address them, and what alternative solutions are there.

He recollected his association with Prof Dr. M Alimullah Miyan, founder of IUBAT who had the concept of sustainable development at that time, i.e. in 1988. He considered not just a batch of teachers or students but also tried to minimize different environmental issues that would affect the sustainability of the university reflected this in the academic curriculum; in the physical design of the campus; in the construction of the building and above all trying to disseminate this idea of living with nature. Prof Miyan had been writing papers and conducting research in environmental sustainability and so on. Following his idea, it is thought that it was the right time to set up an institute in the university to address the issues of SDGs and following his footsteps to involve people from different disciplines to promote the idea of SDG, IUBAT Institute of SDG Studies (IISS) is planning to train up people in SDG; conduct research which can contribute to achieve sustainable development and also trying to develop projects that could actually be shown as a model. IUBAT has started to work on curriculum designing and also planning to open MSc in SDG shortly to train people on SDG through seminars, workshops, and so on. Additionally, we are also trying to identify different government and non-government agencies for collaboration with people who are in this field contributing towards the achievement of SDGs. Through this national seminar, he expressed satisfaction to see a gathering of people working in different SDG areas that has come up with issues to be address. Again, he cautioned that it was not enough to the problems but we should try to find out alternative solutions and then try to implement those through strategy and long-term plans. He concluded by saying that all efforts have just begun pursuing more and more of these kinds of activities in the future and urged for cooperation.

Policy Recommendations

It was a very successful seminar that involved different stakeholders, high officials and researchers from Bangladesh, FAO, RCE Asia Pacific Region and Curtin University, Australia. They made valuable discussion and comments and the recommendations are summarized below:

1. Ecosystems are important for food, biomass recycling, clean water and sanitation, biodiversity, urban sprawling and climate action etc. linking with most of the SDGs 2030 which are given below for policy planning:

- SDG 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture FAO: Sustainable agriculture must nurture healthy ecosystems and support the sustainable management of land, water and natural resources, while ensuring world food security.

Target 2.4. By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

- SDG 3 Ensure healthy lives and promote well-being for all at all ages.

Target 3.9. By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

- SDG 6 Ensure availability and sustainable management of water and sanitation for all.

Target 6.1

By 2030, achieve universal and equitable access to safe and affordable drinking water for all.

Target 6.2

By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

Target 6.3

By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

Target 6.4

By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

Target 6.5

By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.

Target 6.6

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

- Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable.

Target 11.6

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

- Goal 12: Ensure sustainable consumption and production patterns

Target 12.2

By 2030, achieve the sustainable management and efficient use of natural resources.

Target 12.3

By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.

Target 12.4

By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

Target 12.5

By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse.

- SDG 13 Climate Action: Take urgent action to combat climate change and its impacts

Target 13.2. Integrate climate change measures into national policies, strategies and planning.

- SDG 14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Target 14.1

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

Target 14.2

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

- SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss.

Target 15.1. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

Target 15.2. By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.

Target 15.3. By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

Target 15.4. By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

Target 15.5. Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

Target 15.7. Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.

Target 15.8. By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.

Target 15.9. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.

To fulfil these goals and their targets, ecosystems should be managed properly and recycling of the nutrient biomass must be ensured.

2. For food and nutrient security, all ecosystems especially the wet-bodies *viz.* rivers, canals, lakes, beels and jheels etc., and floodplains, croplands and rural homes of the country should be made functional, productive and free from pollution and encroachment.
3. Field ecosystems should be pollution-free and biomass nutrient recycled back to their source of origin. All dead bodies, carcasses, plant residues, refusals and debris etc. must be recycled.
4. Soil survey for all Upazilla should be done in every 10 years to ascertain soil status and must bring under a model.
5. Biological survey including plants, animals and microbial population should also be done for every Upazilla and should bring under model.
6. All septic tanks must be cleaned regularly and the biomass should be recycled. Fecal materials should not drain out from the toilets or septic tanks and all tanks must be cleaned within every two years.

7. All domestic solid wastes should be segregated at source into 1. green garbage, 2. paper, 3. metal and glasses and 4. plastics and polythene to facilitate recycling and reuse
8. All industrial effluents or waste waters must be treated before disposal; clean and fresh treated water only be allowed to drain out into the wet bodies.
9. A proper statistic for crop production, chemical fertilizer uses vis-à-vis annual consumption and biomass recycling should be undertaken.
10. Farmer and Consumer-oriented Production, Processing and Marketing System, should be operated to lead a comprehensive recovery and increase preparedness for dealing with food insecurity.
11. The private universities should have equal access to the funded projects (Bangladesh Climate Change Trust, Disaster management fund, Bangladesh Delta Plan 2100 and FAO, UNFCCC, IUCN, IPBES etc.) like public universities.
12. Ecosystem-based adaptation viz. traditional Rural Home-Centered Aggregated Farming (RHCAF): A home with a forest grove, houses for dwelling and a pond for multipurpose uses, must be protected, revived and developed to make more productive for Circular Bioeconomy: Biodiversity+ Climate+ Recycling.
13. Immediate introduction of sustainable agriculture practices such as adoption of agroecology or ecological farming to overcome the pandemic shock
14. Hill Forest ecosystems should be restored to ensure hydrological cycle, upholding high the water tables to revive the perennial streams
15. Wild fruits are rich in macro and micro nutrients so, more research is needed to explore true potential of many other wild crops available in Bangladesh, adding wild crops in plantation as commercial crop would be a good option to conserve them.
16. Coastal zone management and conservation of mangrove forests are utmost essential to protect the biodiversity rich and most fertile zone of the country from encroachment, illicit logging, fishing and poaching and also from upstream pollution.
17. Involvement of universities with government and suggestions from academia should be an open-door policy.
18. Finding effective solutions of climate change action plans should be scientific and need-based to get resilience on food security.
19. A comprehensive emergency response plan should be adopted to address food security, health and socio-economic recovery measures in COVID-19.
20. To save the varieties and species, climatic adaptation must be respected. Climatic adaptation of crops and domestic animals should be studied.
21. To maintain a balance between the production of marine diversity and industrial activities: SDGs promote the sustainable use of terrestrial ecosystem and citizens sustainability that needs to manage forest combating deforestation and rescue land degradation and save biodiversity.
22. Introduction of exotic species must be restricted and if it is necessary that should be under long term acclimatization.

Conclusion

To ensure food security a healthy and functional ecosystem is of utmost essential. The importance of the ecosystem has also been mentioned in different targets of SDGs 2030. Bangladesh, as a whole, is far behind in the management of healthy ecosystems as described in the keynote paper and also by the discussants. Although the country is progressing at high GDP growth with great success in food production; this achievement must not compromise with the deterioration of the ecosystem and its services and at the cost of human health and biodiversity loss for which immediate action should be taken to improve ecosystem management. The discussants made recommendations for policymakers to take immediate measures to restore the ecosystem for food security, disaster risk reduction (DRR) and climate action. Since the whole world has been experiencing the impact of COVID-19 which is quite new for the global people that is why it is urged to find a new dimensional approach that can minimize the global and regional food security issues through sustainable ecosystem management.

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