



## **The Indian Society of Agricultural Economics**

### **82nd Annual Conference**

**November 10-12, 2022, Imphal (Manipur)**

The Indian Society of Agricultural Economics (ISAE) is pleased to announce its 82nd Annual Conference to be held in Imphal (Manipur) from November 10-12, 2022. This Conference is being organised by Central Agricultural University, Lamphelpat, Imphal (Manipur). Dr. Suresh Pal, Director, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi is the Conference President. Dr. S. Basanta Singh is the Local Organising Secretary of the Conference.

#### **Conference Themes**

1. Sustainable Agricultural Growth, Diversification and Farm Income
2. Gender Equality and Resilient Agriculture
3. Innovations, Access to Technology and Competitiveness of Markets
4. Wetlands, Climate Change and Livelihoods in the North Eastern Hill Region

#### **Dates to Remember**

- Last Date for Submission of papers  
**June 30, 2022**
- Communication from ISAE about Acceptance of Paper  
**July 31, 2022**

#### **Conference Duration**

As has been the convention every year the Conference will start at 9.30 am on the first day and will conclude on the third day of the Conference. Delegates and members who desire to attend the pre-Conference workshop (scheduled if any) are advised to reach Imphal two days prior to the Conference and schedule their departure for the evening of November 12, 2022 or the morning of November 13, 2022.

#### **SUBMISSION OF PAPERS**

The Conference is open to research scholars both from India and abroad. The papers may relate to India at the macro level or regional level. However, ground level studies would be preferred.

The papers should be submitted by email on the Society's email id at [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com)

Length of the paper should not exceed not exceeding 3500 words or 10 pages and should adhere to the current writing style of The Indian Journal of Agricultural Economics (IJAE). For further details, please visit <http://www.isaeindia.org>

All papers should include a summary not exceeding 250 words. As usual the summaries of all accepted papers will be included along with the Full Length Papers in the Conference Number of our Journal.

Authors must ensure that their submissions are original. Please note that all papers will be screened for plagiarism and accordingly accepted or rejected. Further, authors are solely responsible for violation with respect to plagiarism. A final undertaking will be sent to all papers accepted for full length.

**Best Paper Awards and Fellowship:** Every year Indian Society of Agricultural Economics (ISAE) gives best paper awards – Dr. N.A. Mujumdar Prize Award to young scholars below 40 years for the best paper on each of the Conference theme and ISAE fellowship to a senior Indian scholar who has made outstanding contribution in the field of agriculture and rural development.

### **Presentation by Ph.D. Scholars**

In view of the overwhelming response received last year, it is proposed to continue to organise a special session containing paper presentations by Ph.D scholars from different Universities of India.

The award to the maximum best 10 presentations would consist of a memento and a certificate.

It is mandatory for Ph.D. Scholars who present their papers to be a member of the Society. The student's concessional membership fee is Rs. 800/-

In this context, we invite a paper presentation from Ph. D Scholars in the form of Abstract as well as ppt presentation on the basis of their Ph.D Research or any relevant topic pertaining to Agricultural Economics at the 82nd Annual Conference of ISAE at Central Agricultural University, Lamphelpat, Imphal (Manipur).

Entries for the presentation along with the membership fee in the form of Abstract along with their PPT should be sent before the dates which would be announced shortly:

Hon. Secretary and Treasurer Indian Society of Agricultural Economics, C-104, First Floor, Sadguru Complex I, Near Vageshwari, Gen. A.K. Vaidya Marg, Goregaon (East), Mumbai-400 063. Tel.: 022 40143951. Email: [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com)

### **Panel Proposals**

During the conference, it is planned to organise a panel session including a pre-conference event. Proposals for panels are invited from scholars and institutions.

Each panel proposal should contain the following:

- Title of the panel and a description of the panel's theme
- Titles, authors and abstracts (within 500 words) of the papers to be presented
- Names, affiliations and short biographies (100-150 words) of the proposed presenters and discussants/commentators
- Name and contact information of the panel organiser

Note: A panel session will comprise of 4 – 5 paper presentations. The organisers / coordinators of each Panel Session are expected to be in charge of the Panel Discussion, including raising resources for speakers' travel and other expenditure. The proposals may be emailed to [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com) by **July 31, 2022**.

### **Travel Arrangements**

The Indian Society of Agricultural Economics does not have any regular source of funding. As such, it is expected that the Conference Presidents, the Keynote paper-writers, Rapporteurs, paper presenters, resource persons and other participants will fund their travel costs through their own institutions or other sources.

### **SOCIETY'S MEMBERSHIP**

The rates for Membership is as follows:

Life Membership Fees	Rs. 10000
Annual Membership Fees	Rs. 1000
Student Membership Fees	Rs. 800

### **MODE OF PAYMENT**

The Society's fee may be paid by way of NEFT/RTGS transfer/Demand draft (DD) or local cheques.

#### **Details for NEFT/RTGS transfers:**

Account Name	: The Indian Society of Agricultural Economics
Account Number	: 54025434745
Bank Name	: State Bank of India
Branch	: M G Road, Fort, Mumbai

IFSC Code : SBIN0020634  
MICR Code : 400002467

Kindly inform us when the amount is remitted to our account.

**Details of payment through demand draft or cheques**

Demand draft/cheque may be sent in favour of “Indian Society of Agricultural Economics” payable at Mumbai at the following address:

The Indian Society of Agricultural Economics,  
C-104, First Floor, Sadguru Complex -1,  
Near Vagheshwari, Gen. A. K. Vaidya Marg,  
Goregaon (E), Mumbai - 400 063.  
Tel.: 022-40143951  
Email: [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com)

**Society’s President**

Prof. Dinesh K Marothia  
Indian Society of Agricultural Economics  
C-104, First Floor, Sadguru Complex I,  
Near Vagheshwari, Gen. A.K. Vaidya Marg,  
Goregaon (East), Mumbai - 400 063  
Tel: 022 40143951  
Email: [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com)

**Conference President**

Dr. Suresh Pal,  
Director,  
ICAR, National Institute of Agricultural Economics and Policy Research  
NEW DELHI – 110 01  
Email: [spl.econ@gmail.com](mailto:spl.econ@gmail.com)

**Local Organising Secretary**

Dr. S. Basanta Singh  
Director of Instruction  
Central Agricultural University,  
Imphal (Manipur)  
Email: [di.office@yahoo.com](mailto:di.office@yahoo.com), [bsantasinghsoibam@rediffmail.com](mailto:bsantasinghsoibam@rediffmail.com)

**Hon. Secretary and Treasurer**

Dr. C.L. Dadhich  
The Indian Society of Agricultural Economics,  
C-104, First Floor, Sadguru Complex -1,

Near Vagheshwari, Gen. A. K. Vaidya Marg,  
Goregaon (E), Mumbai - 400 063.  
Tel.: 022-40143951  
Email: [isaeindia1939@gmail.com](mailto:isaeindia1939@gmail.com)

## SUGGESTIVE OUTLINES ON CONFERENCE THEMES FOR PROSPECTIVE CONTRIBUTORS

The 82nd Annual Conference of the Indian Society of Agricultural Economics will be held under the auspices of Central Agricultural University, Imphal (Manipur) from November 10-12, 2022.

The following subjects are selected for discussion:

1. Sustainable Agricultural Growth, Diversification and Farm Income
2. Gender Equality and Resilient Agriculture
3. Innovations, Access to Technology and Competitiveness of Markets
4. Wetlands, Climate Change and Livelihoods in the North Eastern Hill Region

Research Papers on the above themes are invited from members and other paper-writers for discussion at the Conference. The scope of each of the four themes is spelt out in the enclosed brief and detailed synopsis on four Conference themes given below to enable the paper writers to initiate the process of preparing their papers. The brief and detailed Indicative Outlines are also available on the Society's website [www.isaeindia.org](http://www.isaeindia.org).

The soft copy of the paper (not exceeding 3500 words or 10 pages), with its Summary not exceeding 250 words need to be submitted. The last date for the receipt of the papers at the Society's office is June 30, 2022.

### SUBJECT I

#### SUSTAINABLE AGRICULTURAL GROWTH, DIVERSIFICATION AND FARM INCOME\*

Agriculture-led growth is the key to sustainable development as it reduces poverty by raising farm incomes,

---

\*Prepared by Dr. B.C. Roy, Hony. Director, AERC (Visva-Bharati & MoA&FW, Gol) and Professor, Department of Agricultural Economics Institute of Agriculture VISVA BHARATI, Visva-Bharati, Sriniketan-731236 (West Bengal).

generating employment, stimulating the non-farm economy, and lowering prices of staple foods. In an agrarian economy like India, where a significant proportion of the population still depends on agriculture, raising farm income and maintaining long-term sustainability of agricultural systems is of critical importance. Recently, Indian agriculture has grown much faster and close to 4 percent in some years. How this growth can be sustained when the agriculture sector is facing numerous challenges like plateauing productivity in some crops, depleting natural resource base,

and accelerated climate-induced weather risks. These need to be addressed by adoption of sustainable agricultural practices (SAPs) and policies. SAPs are also context specific, and so are the research needs. A better understanding of the constraints and their potential solutions and providing a favourable policy environment and incentives are necessary to make the growth inclusive and sustainable.

Acceleration of agricultural growth in recent years is largely attributed to diversification towards high-value sectors. The literature on crop diversification is quite rich on the determinants of crop diversification and their impact on farm income. There are, however, not many studies on the impact of crop diversification on sustainability of natural resources. There are dearth of studies analysing the relation between crop diversification and vulnerability of poor farmers to climate change. Given the pre-dominance of small and marginal farms, increasing farm income in order to ensure a decent livelihood has been a much sought after yet an elusive goal of sustainable agricultural growth in India. Diversification towards high value crops and commodities is considered to be an option to increase income of small farmers and transform agriculture into a more profitable, efficient, and environment-friendly. Empirical evidence on the linkages among sustainable growth, diversification and farm income would help in devising appropriate policies with harnessing the potential of technology, rural infrastructure, and institutional

interventions. Since the green revolution, India's agricultural policy making has been production-centred which of late shifted towards raising farmers' income and value addition. How to accelerate this trend and make agricultural more diversified, inclusive and sustainable?

Public investment for creating infrastructure and support services like irrigation and R&D, was the major source of growth which has high impacts in terms of raising agricultural productivity and reducing poverty. Although investment is a better option than subsidy in increasing agricultural productivity and reducing rural poverty, it is a matter of serious concern that the share of investment in total public expenditure is declining over time. Corporate investment is also not picking-up as expected. Farm household investment though rising but not in the areas of sustainable agricultural development. Therefore, it is necessary not only to increase public investment in agriculture but also to prioritize the investment portfolio across the regions and items of investment. In addition to the investment in physical 'hard' infrastructure, there is a case for development of soft infrastructure too. Higher investment in education, information dissemination, research and extension services to farmers will go a long way in sustaining agricultural growth.

The NITI Aayog, at national level, identified the future sources of growth in agriculture and farm income through increase in agricultural productivity, improvement in the total factor

productivity, diversification towards high value crops, and increase in crop intensity along with shifting cultivators from farm to non-farm occupations, and improvement in terms of trade for farmers or real prices received by farmers. However, the scope for harnessing such sources varies across the regions and subsectors. Empirical evidence has also shown that the technology generation and dissemination impacts have not remained uniform across the regions as well as across crops. Therefore, there is a need to identify region specific future sources of growth in crop production, dairying, livestock, fisheries, etc. In particular, there is limited information on supply-side sources of growth in livestock (except poultry), horticulture and fisheries sector. Changing relations between farm and non-farm sector also need to be examined in the context of recent growth pattern.

Another important issue is climate change that presents a major risk to sustainability of agricultural systems. Climate change has now become a reality in India as we are experiencing extreme climate events more frequently than before, which are adversely affecting agricultural production, farm incomes and food security. Understanding climate change risks and the way different stakeholders responds to such risks and their impact on farm income is a topic that deserves attention of researchers. Most existing research has focussed mainly on impact of the changes in mean temperatures and rainfall on crop yields. Studies that examine the relation between climate

change risks with vulnerability of different livelihoods would advance our understanding. This should be backed with the measures for mitigation and adaptation to climate change and institutionalisation of these measures in the governance. The issue of climate-resilient agriculture is at the heart of the agenda for Sustainable Development Goals (SDGs) and first fundamental step to securing zero hunger and no poverty. How these contributions of agriculture to SDGs can be realized in a time-bound manner?

Agriculture being a state subject in India, states has the primary responsibility for the growth and development of this sector. However, the Government of India supplements the efforts of the State Governments through various schemes or programmes. However, gaps in implementation of the schemes and coordination between the centre, the states and local agencies is also evident in some cases. It is, therefore, necessary to assess the roles of states in effective implementation of the policies and programs for sustainable agricultural growth, diversification and exports. Examples of successful state policies, shift in market orientation, and development strategies shall provide new insights on the development approaches. The role of civil society or farmer organization (CSOs) and business sector should be examined for strengthening the support to agriculture and improving effectiveness of public investments and schemes.

The issues of sustainable agricultural growth, diversification and farm income

are closely interlinked. In spite of significant development in quantitative techniques, there remains several methodological difficulties in measuring long term sustainability of agricultural systems, developing scale neutral diversification indices, governance reforms, and reliable and comparable estimates of farm income. There is also a need for robust methodology for identifying the priorities and challenges within the various dimensions of sustainability in a dynamic setting and incorporating a sufficient length of time horizon.

Research papers are solicited on the issues discussed here which are indicative. The contributors may choose any of the specific issues listed below or could combine the issues as long as they remain focussed on the theme and within the size limit prescribed for conference papers.

- What are the recent trends and regional pattern of agricultural growth, diversification and farm income? How the growth and diversification impact farm income? How the diversification can help both ensure growth as well as promote sustainability of the production systems? Can system diversification also helps building the resilience to climate change? What are the effects of input subsidies and MSP on crop diversification?
- Analysis of the past sources of agricultural growth forms the basis for identification of future sources of growth. The past sources of agricultural growth like investment, technology and price incentives can be assessed in different agro-environments. For example, what are the reasons for very high level of growth in fisheries sector in recent years? How far the past sources of growth can be made sustainable? Regional and sectoral evidence on sustainability of the agricultural production systems and adoption of SAPs shall be useful for their outscaling.
- Enhancing agricultural productivity requires efficient use of inputs, introducing new technology and shifting from low to high value commodities. Thus, it would be worth studying the capital use efficiency, technology-induced efficiency and labour productivity in agriculture across crops, enterprises, and regions. To what extent labour-capital substitution is taking place?
- Assessing adequacy of public investment for achieving desired growth in agriculture across the states and sub-sectors in agriculture require to be examined. What kind of incentives and regulatory framework are needed to promote private investment (both farm household and corporate) in agriculture for higher agricultural growth? Have the recent governance reforms contributed to the effectiveness of public investment and schemes and improved incentive and income for farmers?
- Linkages between agriculture and rural non-farm sector are getting stronger and multi-dimensional.

This requires further analysis and elaboration of the impact of growth in non-farm sector on agricultural growth and farm income. How and why diversification of income sources is taking place in rural areas? To what extent rural non-farm sector can absorb surplus labour from agriculture and how this transfer can be accelerated?

- Government has accorded high priority to agriculture and has come out with several policy and schemes. How far such policies and measures, particularly higher revenue expenditure, are sustainable in the long run? What are the cross-cutting evidence on effectiveness of government schemes and policies in achieving sustainable agricultural growth and enhancing farm income?
- What are the implications of widespread disease breakthroughs and like situations now and in the future? Diverse agricultural and food policy measures were adopted in India and abroad to overcome this situation. The main purpose was to reduce the vulnerability of the poor but might have impacted the actual resilience of agriculture sector. The lessons learnt will be crucial in developing sound policies.
- Since agriculture in India is a state subject, what is the role of centre, state and civil society organizations in achieving sustainable agriculture development? This can be examined in the broad framework of the role of state, markets and CSOs in the development. Also, how to reduce inter-state disparities and promote

regional congruence in agricultural growth and farmers' income?

- Research papers on methodological issues in measuring long-term sustainability, vulnerability to climate change, development of scale-neutral diversification indices, governance reforms, and preparation of comparable estimates of farm income are welcome.
- Almost all the state governments have prepared and submitted mid-term progress report on SDGs. What is the status of inter-state performance in achieving SDGs? What are the future sources of growth in agriculture and allied sub-sectors across the regions? What policy reforms are needed to achieve higher levels of agricultural growth? What types of interventions are required to make agricultural system sustainable in terms of economic viability, environmentally sustainable and climate resilient? The system diversity for reducing the vulnerability and building resilience can be analysed using regional or micro-level evidences. Also investment priorities and policy shifts for climate-resilient agriculture can be examined.

## SUBJECT II

### GENDER EQUALITY AND RESILIENT AGRICULTURE\*\*

---

\*\*Prepared by Dr. Raka Saxena, ICAR- National Institute of Agricultural Economics and Policy Research, New Delhi-110012.

Women have played crucial role in agricultural development and allied fields including crop production, livestock, horticulture, post-harvest activities, agro-forestry and fisheries. The donor agencies, Governments and community organizations are targeting women as priority clients and strengthening efforts to empower women and reduce the inequality. These concerns have also been echoed through the Sustainable Development Goals (SDGs) and one of the 17 SDGs is “Achieve gender equality and empower all women and girls” (SDG#5). Women account for approximately 30 percent of the agricultural work force in India. Despite the Government efforts and schemes to empower the female workers, the gender gap in Indian agriculture is massive. This gender gap might have impacts on literacy, health, and productivity. Thus, the convergence of initiatives at the policy level is the need of hour to ensure nutrition, health, livelihoods, and empowerment to women farmers. The impacts of outmigration are highly gendered, outmigration of men has led to the ‘feminization’ of agriculture in rural communities, where women are the majority of participants in farming activities. Designing an effective gender intervention framework requires knowledge of context and domain specific heterogeneity in women empowerment in agriculture.

Ownership of assets is important for poverty reduction, and women’s control of assets is associated with positive development outcomes at the household and individual levels. Apart from the

substantial male bias in inheritance laws and the gaps between laws and practice, government land distribution programs have widened the gender gap in command over arable land. Ownership of land plays a major role in credit worthiness, providing women with joint rights to agricultural land, could go a long way for achieving greater command over financial resources and savings. The existing empirical studies of the ‘gender in agriculture’ literature consistently reveal that women lack access to and control over resources such as land and capital as well as agricultural inputs and technology such as improved crop varieties, training, information and marketing services. Due to the multidimensional nature of empowerment and the diversity of gender systems, the study of women empowerment in agriculture is essential to capture the regional variations in addressing gender needs and constraints. Thus, the holistic agenda for gender sensitive agriculture entails information and evidences on the following to facilitate designing gender inclusive framework:

1. **Asset Ownership, Decision Making and Empowerment:** It is important to draw the evidences on gender discourse, gender bias and gender norms to understand the structural drivers of gender disadvantage and the potential for change. The Hindu Succession (Amendment) Act, 2005 (39 of 2005) was enacted to remove gender discriminatory provisions in the Hindu Succession Act, 1956. The studies may focus on

disaggregated analysis in terms of evidence on asset ownership, intra-household dynamics and role in decision making, extent of empowerment and their impact on livelihood outcomes. The studies may also focus on impact of various empowerment measures--legal, capacity creation and other social measures.

2. **Gender and Technology: Improving access to modern agricultural inputs and technologies amongst women farmers** is ideal for raising agricultural outcomes. Thus, evaluating gender-related differentials in modern input use is an essential inquiry for policy. Studies may address the research issues related to responsiveness of R&D system, gender mainstreaming and technology need-assessment. Further, women play crucial and significant role in livestock rearing, hill agriculture and post-harvest management; disaggregated evidences on the specialised contributions would be helpful in appropriate policy outcomes.
3. **Wage and Income Disparity: Gender discrimination in agricultural labour markets** is a significant barrier in the agricultural development. The gender difference is quite pronounced in the daily wage earnings of the regular wage/salaried persons, wage for women is less than their male counterparts for major agricultural operations in almost all the major states. Women's choices are also lessening due to social and cultural

constraints, gender bias in the labor market and lack of supportive facilities in the labor market. Lack of information regarding their legal rights is another major obstacle. Women are constrained because of cultural, traditional and sociological factors. Studies may provide evidence through regional and enterprise-based researches.

4. **Markets Access, Farmer Collectives and Institutional Finance: Integrating women into modern value-chains (MVC)** requires a holistic approach in terms of identification of bottlenecks and opportunities to participate effectively in production, marketing and value-addition activities. There is paucity of information on analysis of gender-disaggregated value chains. Studies may select specific value chains and product innovations, market actions & linkages, and control over income. The case studies may focus on how women farmer collectives (SHGs and FPOs) have performed, improved the bargaining power of women, enhanced incomes and access to markets. Further, the studies may highlight the institutional mechanisms for credit and farmer collectives in agriculture. Further, there is little evidence where well-meaning Women SHGs collapsed due to poorly designed institutional mechanisms and internal conflict of interest. It may be interesting to investigate inequality and disparities in terms of inclusiveness and distribution of

- cost and gains within women SHG/s with heterogeneous socio-economic structure.
5. Agriculture, Nutrition and Gender Linkages: Women play key role in the linkages between agriculture and nutrition. The literature on intra-household dynamics and intra-household allocation has recognized the importance of role of women in attaining dietary diversity and improving nutritional outcomes for their families. Micro-level studies may prove this proposition and provide appropriate evidences.
  6. Climate Resilient and Sustainable Agriculture: Understanding the gender differences in vulnerabilities and adaptive capacities is essential for sustainable agriculture, communities and food systems. Research questions may focus on how climate smart practices and technologies need to be engendered to benefit women farmers to increase the efficacy of their response to climate change. The information on resilience of gender-based systems, particularly during the pandemic times, would be crucial. Access to common pool resources is often insecure, if not totally lacking among marginalised groups of women. Pro-women natural resource tenure is extremely relevant to poverty reduction, environmental sustainability, gender equity and protection of human rights. Even a few well-informed case studies can add value to deliberations.
  7. The studies may focus on specific contribution of women in agriculture across regions, states and ecologies. Various Government programmes have enhanced the participation of women in local bodies and led to effective outcomes. Role of women in R&D, extension, local bodies, farm management and local support services may be highlighted. Evidences on the impact of these initiatives and interventions would be helpful in taking corrective actions and improving the effectiveness. Information on how this participation has influenced the priority setting and monitoring agenda would be imperative? Further, evidences on contribution towards fulfillment of the SDGs would be vital.
  8. Access to ICT can help women gathering information about financing and markets. The studies on gender related impacts and women micro-entrepreneurship in rural areas are scanty. Evidences may be generated on how the digitization and ICT has helped women agripreneurs and agribusiness? Women-led SHGs in many parts of the country succeeded in bringing the women to the mainstream of decision-making and strengthened forward and backward linkage for consistence growth and greater outreach. Interestingly, many women SHGs have developed their own production, processing and marketing innovations to add marginal value at each stage of

value chains. The case studies with objective evidences may be useful on various success stories in agribusiness (horticulture, sericulture, animal husbandry & fisheries, mushroom, vermi-compost, herbal products, plantation crops) and secondary agriculture activities related to agro-forestry, NTFPs, bamboo, jute, khadi & handicrafts and other micro-industries.

### SUBJECT III

#### INNOVATIONS, ACCESS TO TECHNOLOGY AND COMPETITIVENESS OF MARKETS\*\*\*

Given the complexity of Indian agriculture, technological and institutional innovations are necessary to meet the triple bottom lines of raising income of small farmers, strengthening the competitiveness, and promoting sustainable agro-ecosystems. However, recent challenge of climate change and its impact on Indian agriculture and resource-poor farmers are unprecedented, and there is an urgent need to put in place the measures for adaptation and mitigation to climate change. There are issues of the management of agricultural waste and crop residues, so as to give equal importance to the environment and sustainability along with farm profitability. On the supply side, food and agriculture sector have often longer

value chains, which begins at the pre-production level and extends up to final consumption by the end-users, and these value chains have varied level of efficiency. The support system of the value chains and production systems like finance, insurance, weather information, market, etc. also have several issues relating to their efficiency and inclusiveness. In every stage and process, there are umpteen opportunities for technological applications and innovations to make support system responsive and agriculture competitive and environmentally sustainable.

The solution to most of problems lies with technological and institutional innovations, which have seen a sea change over the years. Paradigm shift has happened in agricultural input sector. There is considerable change in nature of technology and its providers. The seed sector transformed from an informal to a formal system both at the national and global levels. It has brought rapid expansion in the area under improved seeds of different crops. Similar changes are observed in other agri-input sectors like agro-chemicals, plant nutrients, irrigation technology, agro-advisory services, etc. Apart from this, there has been significant shift in the development of high quality feed and vaccines for livestock and fisheries sector. In other allied sectors, like agroforestry, non-timber forest produce, aquatic sector, etc., there might be several innovations, including traditional knowledge-centric innovations to organized product markets and value addition. Most of these innovations remained less studied, and therefore

---

\*\*\*Prepared by Dr. Ranjit Kumar, Principal Scientist & Head, Agribusiness Management Division, ICAR-National Academy of Agricultural Research Management, Hyderabad- 500 030 (Telangana).

these innovations and their benefits therefore need to be analysed empirically.

Agricultural input as well as output markets also face several imperfections, influencing the cost and efficiency of the delivery mechanism for different stakeholders. Recent surge in agri-startups, particularly agritech-startups, have promising kitty of technologies which may change the face of agriculture in entirety. The applications of data science, artificial intelligence, internet of things (IoT), drones, remote sensing, geospatial mapping, etc. are being used in different parts of the country as use-case. With the use of different types of sensors capturing real-time data regarding soil nutrient status, pest surveillance, weather information, etc., these modern technologies are combining the trillions of bytes of data to help the farmers in better decision making. Similarly, these are also helping the supply chain players to decide about the market arrivals- quantity as well as quality. Furthermore, there are challenges of “last mile delivery and dissemination” with several of these modern technologies and innovations. These developments have also attracted private for-profit sector, having implications for cost and efficiency of the delivery, which need to be examined. Digital revolution has changed drastically the relations among various actors in the input and output markets, reduced the transaction cost, and shortened the supply chains. In some cases, innovations in the post-harvest sector have influenced the value chains and participation of farmers in a

big way. The lessons from these developments should be documented for their outscaling.

Technological and institutional innovations have influenced the diversification and competitiveness of agricultural markets. There is an increase in the participation of private sector in R&D and vertical coordination between R&D and input delivery system. These changes are further enforced by strengthening of intellectual property rights in agriculture. This has provided a framework to establish the partnerships and contracts among the input companies and R&D organizations. In recent past, more than 100 Agriculture Business Incubators (ABIs) have been set up at different academic and research organizations- in public as well as private domain by creating enabling government policies and funding support. These centres are further speeding up the process of technological development, innovation and farmers’ access. Besides, there are international technology spillovers and transnational operations of input companies. Since many technologies, particularly biological and chemical, are delivered through various types of inputs, input markets are also changing rapidly. There is a need to study these changes in the context of market competitiveness and input prices.

It would be of great value and interest to analyze above changes in input and product markets and their influence on access of small farmers to market and technology. Also how these changes have affected overall efficiency of input supply chains and agri-food systems.

Some of the indicative questions which the paper contributors can address are given below:

- How the innovation systems in crops, horticulture, livestock, aquatic, and agroforestry sectors have changed over the years and what are the driving forces?
- How much progress precision agriculture has made? Is there any specific micro-sector, where the technology adoption has been significant? What are the drivers of adoption of precision technology and how its supply industry is evolving?
- In which way, the innovations and modern technologies are helpful, like in improving soil health, reducing groundwater use, reducing GHG emissions, reducing different types of pollution, establishing traceability and quality control system, etc. and how the delivery of the technology is evolving in an era of commercialisation?
- Whether agricultural innovations are equitable in terms of access to small, resource poor farmers, and what are the drivers of their adoption? The role of private companies can also be analysed in this context.
- How diversification of the innovation systems, particularly participation of larger input companies, has affected structure and competitiveness of input markets or industry and delivery of technologies to Indian farmers? The impact on input prices and access of

small farmers to technology should also be analyzed.

- How have the geographical indications (GIs) for regionally important agricultural commodities have affected farmers' incentives and their inclusiveness in the supply chains?
- In which way, the government schemes and policies are helping in speeding up the innovation cycle and technological advancements in agriculture? Also, cost-effectiveness of technology and the regulations like IPRs, and distribution of the gains in major sectors like seed, agro-chemicals, animal health and food processing can be examined for better insights and lessons.

#### SUBJECT IV

#### WETLANDS, CLIMATE CHANGE AND LIVELIHOODS IN THE NORTH EASTERN HILL REGION†

#### INTRODUCTION

Wetlands are considered to be highly productive ecosystems which provide numerous goods and services to the living being but also an ecologically very sensitive and adaptive system. They could be diverse in nature based on their genesis, location, water regime and chemistry, dominant species, and sediment characteristics. They provide numerous ecological goods and services but are under tremendous stress due to land use change in the face of population growth, rapid urbanisation,

---

†Prepared by Dr. S.M. Feroze, Associate Professor and Head, Agriculture Economics, College of Agriculture, CAU, Imphal.

industrialisation, agricultural intensification, increased economic activities, pollution and climate change. All these lead to decline in wetland areas, the hydrological, economic and ecological functions they perform. The global total wetland area is estimated to be around 1.5-1.6 billion ha covering about six percent of the world's surface, are the biodiversity hotspots but since 1970 the wetland areas have shrunk by 35 %, at three times faster rate than the forest. At the same time the inland wetland-dependent species have declined far more than species dependent on other biomes. To ensure Conservation of wetlands worldwide, especially as habitats for waterfowl, representatives of a few international organizations and national governments signed, on 2nd February 1971 at Ramsar city of Iran, an agreement called the Ramsar Convention on Wetlands of international importance. The Convention was originally contracted by seven countries when it came into force on 21<sup>st</sup> December 1975. The Ramsar convention entered into force in India on 1<sup>st</sup> February 1982 and so far 47 sites have been designated as the Wetlands of International Importance (Ramsar Sites) under the Ramsar Convention.

The Ramsar Convention has adopted the following definition of wetlands to cover almost the whole range of inland and coastal aquatic ecosystems.

*“Areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not*

*exceed six meters”.* And *“may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands”* (Ramsar Convention Secretariat, 2013). For practically the same reason, the Ramsar Convention considers lakes and rivers also as “wetlands in their entirety, regardless of their depth” (Ramsar Convention Secretariat, 2013).

The Ramsar Convention (2013) recognized five major wetland types: *Marine* (coastal wetlands including coastal lagoons, rocky shores, seagrass beds and coral reefs); *Estuarine* (including deltas, tidal marshes and mudflats, and mangrove swamps); *Lacustrine* (wetlands associated with lakes); *Riverine* (wetlands along rivers and streams); *Palustrine* (meaning “marshy” – marshes, swamps and bogs). In addition, there are *human-made wetlands* such as fish and shrimp ponds, farm ponds, irrigated agricultural land including rice paddies, salt pans, dams, reservoirs, gravel pits, wastewater treatment ponds and canals. The Convention has adopted a Ramsar Classification of Wetland Type - which includes 42 types, grouped into three categories: Marine and Coastal Wetlands, Inland Wetlands, and Human-made Wetlands (Ramsar Convention, 2016).

The proposed United Nations SDGs, for the first time, recognises the need for restoration and management of water related ecosystems, including wetlands, to address food, water scarcity and water, livelihoods and climate

change. Such initiatives have improved the database related to various aspects of wetland ecosystems across the countries and their ecological zones, including the northeast region of India.

#### *Wetlands Status in the Northeast Hill Region*

Total wetlands in India is estimated to be 15.9 Mha out of which 1.06 Mha is located in the Northeast (NE) region of the country accounting for around 4.17% of the total geographic area of the region. There are 7,731 wetlands found in the region, in addition to 11,736 very small wetlands. Major wetland types of the region are rivers, streams, lakes, ponds, caves and Karst systems. Assam has the highest number of wetlands in NE region with 5,097 major wetlands and 6,081 small wetlands which covers about 7,64,372 ha accounting for around 9.74 per cent of the total geographical area of the state, followed by Arunachal Pradesh (434), Tripura (432), Nagaland (267), Meghalaya (135) and Manipur (67). Only 47 of these numerous wetlands in India have been designated as Ramsar Sites out of which three sites are located in NE region India which includes Deepor Beel in Assam (40 sq.km., designated in 19<sup>th</sup> August 2002), Loktak lake in Manipur (266 sq.km., designated in 23<sup>rd</sup> march 1990) and Rudra Sagar in Tripura (8<sup>th</sup> November 2005). Hence, others are out of the important policy purview though they too perform potentially valuable functions. In the remaining NE states of Arunachal Pradesh, Nagaland, Mizoram, Meghalaya, Sikkim none of the wetlands is declared as Ramsar sites.

#### *Wetlands as Providers of Ecological Goods and Services*

Like all other ecosystems, wetlands also supply numerous services and goods to the human society and animal kingdom; and help to sustain the balance of nature through different functions. They provide important services, viz., biodiversity maintenance, carbon sequestration, flood control, groundwater recharge, etc. and goods, viz., water supplies for domestic use and irrigation, fisheries, non-timber forest products, recreations etc. Wetlands are rich repository of biodiversity and support a wide species diversity by providing habitat as well food through photosynthesis and recycling of nutrients. Some of the species depend on wetlands for their entire life cycle while others during particular stages of their lives. These wetlands act as a sink for pollutants/contaminants in diverse agricultural and urban landscapes. They reduce the load of free-flowing water by removing nitrate and phosphorus from surface and subsurface runoff through nitrification, sedimentation, uptake by aquatic vegetation but because of increased urbanization and land use changes, the nutrient loading in wetlands now exceed their capacity to retain pollutants which manifest in poor water quality and loss in biodiversity.

Wetlands assist communities in fighting or adapting to climate change effects which are increasing at greater pace across ecologies, including the hill ecology. Wetlands contribute a considerable share (about 40-45%) to

global (CH<sub>4</sub>) emissions but they, among the terrestrial ecosystems, have maximum carbon density. The dense vegetation of wetlands plays a significant role in carbon sequestration through regulation (of process like decomposition), capture and storing greenhouse gasses (GHGs). Wetlands act as natural protection against the storm surges and flooding by absorbing and reducing the speed of water flow, providing buffer and the vegetations prevent soil erosion by trapping sediments. Deepor beel in Assam acts as a natural storm water reservoir during the monsoon season for the Guwahati city. They also may become an important source of water supply during droughts or in the event of melting glaciers at high latitudes.

The importance of wetlands for sustainable livelihoods cannot be overemphasized in the era of climate change. Many wetlands support fisheries, agriculture, livestock, forestry, fuel production, therefore sustain the livelihood of local communities and are part of the solution to the food security issues. About 70 percent of the population depends on farming in NE regions and majority of them cultivate wetland rice in valleys. The total area under rice is about 3.51 Mha accounting for about 80 per cent of the total cultivable land of the region. Majority of fish production in the country is from inland water bodies (74 per cent of total production), i.e., rivers, canals, reservoirs, tanks, ponds, and lakes. Over 53.73 lakh people depend on inland fisheries in India for a living. The NE region produces about 0.214 MT of fish,

half of which comes from aquaculture and 90 per cent of the total population of the region consumes fish. In addition to that communities collect and trade traditional wetland products viz., medicinal plants, dyes, fruits, reeds and grasses. About half of the total estimated expenditure is spent on seeking relaxation in wetland areas by the tourists of the globe. Many of the reservoirs such as Loktak lake, Deepor Beel, Umiam lake, are the major tourist attractions in NE states which also provides employment and income to the local communities. Up to 95 per cent of the approximately 10,500 people from the 10 surrounding villages of the Maguri Motapung Beel located in Assam are directly dependent on the wetland.

#### *Depleting Wetlands Pose Challenges to Livelihood in the Face of Climate Change*

The wetlands are shrinking in India including NE region of the country due to various accounts viz., population linked drivers as well as climate change. Comparison of database of the 1990s and today, reveals decrease in the area of wetlands even located at altitude of 3000 m in Arunachal which may be linked to climate change. The increased population has necessitated change in land use pattern, developmental activities, increased urbanisation, illegal construction, encroachment, greater pollutants which all reduce the wetland areas. Gradual conversion of wetlands to agricultural uses, such as for rice farming and aquaculture for meeting the food requirement and employment

opportunities are reported. Shifting from traditional to high yielding varieties increased the fertiliser consumption and pesticide application in India many folds, about 10–15 per cent of that eventually find their ways to these water bodies. The negative economic, social, and environmental consequences of declining water quality in wetlands is particularly more pronounced in case of small water bodies such as lakes, tanks and ponds. Deepor Beel in Assam has been reducing due to urbanisation, and the water quality is impaired due to municipal solid waste dumping. The railway track besides it adds to the problem to the conflict among different stakeholders viz., fisherman, and elephants. Wetlands are said to be too popular for their own good. Maguri Motapung Beel, near the confluence of three rivers from the Brahmaputra, is in danger due to overfishing, silt and floods, and oil exploration. The increasing human footfalls have also taken a toll on these wetlands.

Climate change is a reality and happening at a faster rate than anticipated earlier with increase in mean temperature, increased intense rainfall and drought events, decreased number of rainy days etc. Climate risks are negatively impacting the wetlands in different ways based upon their geographical locations and eventually its resources and the livelihood of local population dependent on it. It is suggested that high altitude wetlands and coastal wetlands are some of the most sensitive classes that will be affected by climate change in India.

Loss in wetland areas results in adverse impact on the key functions performed by wetlands. The wetland species, especially those that cannot relocate to suitable habitats, as well as migratory species are directly hit by loss in wetland areas. This will also have a huge impact on poor families who depend on these water bodies for domestic water supplies, irrigation and fisheries.

However, doubts are raised on the robustness of climate models used for projecting the extent of loss and degradation or decline of wetlands due to climate change. Further, climate change is not the only factor contributing to change in the hydrological regime of wetlands, there are other real physical and socio-economic processes responsible for such changes. Agriculture is one of the key drivers of wetland degradation, but the future of sustainable food production is dependent on healthy wetlands and wise use of it. So, transformation of agriculture is urgently needed to reverse these trends. The irony is that all the stakeholders claim a stake in wetlands but are hardly willing to pay for the goods and services it provides as they are in the open access regime.

#### *Wetland Researchable Issues*

In the Indian context wetland ecosystem have received focused attention of a few agricultural, natural resource and environmental economists, ecologists, anthropologists, geographers, hydrologists, geologists, environmental journalists and activists, bio-scientists,

remote sensing and environmental engineers and scientists, wetland international organisations, donor agencies, and non-governmental research and development organisations. Wetland ecosystems have not been discussed in annual and regional conferences of the Indian society of agricultural economics. To fill this visible research gap a special theme is being organised with focus on wetlands climate change and livelihood in the Northeast Region. Isolated, fragmentary and occasional studies have been made to document wetland biodiversity, distribution of biota, avifauna, a few habitat factors, pollution and water quality by researchers in some institutions of NEHR. However, these research studies largely investigated wetland ecological and biodiversity using a single discipline framework. An interdisciplinary framework can improve our collective understanding to deal with complex multi-use and multifunctional wetland ecosystems under changing socio-economic, cultural, ecological and political, institutional and governance environments.

Against this backdrop papers are invited to address the following issues. Papers from scholars from diverse backgrounds, using interdisciplinary theoretical and empirical approaches, are most welcome. Such teamwork may produce comprehensive and well informed research, and will certainly add value to deliberations.

1. NEHR has a large diversity of wetlands, including Karst wetlands,

wetland inside and outside forest and protected areas and national parks, temples and sacred ponds. Typology and distribution of different wetlands and their ecological status (including pollution and other threats) in different agro-climatic regions of different NE states need to be documented using field and remote sensing data base.

2. Case studies of specific wetland/s covering bio-physical, socio – economic, ecological, cultural, religious, recreational, governance and institutional issues will certainly add value to the growing understanding about diverse categories of wetlands.
3. The NEHR has three Ramsar internationally important wetlands (Deepor Beel, Loktak lake and Rudrasagar). A few studies have been carried out earlier to investigate bio-ecological aspects. These wetlands are suffering due to urbanization, population, poor law, institutional and policy failures. These wetlands need to be revisited to document their status, threats and benefits in the face of climate change. Authors are also required to estimate total valuation of different ecosystem services and existing governance hierarchy (property rights regimes). Lessons from such studies may also help researchers and policy makers dealing with management of Ramsar wetlands sites elsewhere in the country.

4. The recognition of the total economic values (use and non-use values) and functions of wetlands, interpreted in recent years as ecosystem services (Provisioning, Regulating, Cultural, and Supporting services), has resulted in several studies. Such evidence is required for Indian wetlands as well as NEHR. To enhance understanding of wetland managers and policy makers about the drivers that determine structure and functions of wetland ecosystems need focused studies. Adequate research material pertaining to theoretical framework, methods and their application are available. This research back up can help paper writers to choose appropriate sampling procedure, data collection, analytical techniques and interpretation of findings.
5. Wetlands are a solution for several key challenges related to water, food and climate, and key to meeting the SDGs. The authors may like to assess the role of different wetlands in achieving SDGs in different agro-climatic zones of different states of NEHR.
6. Are NEHR wetlands resilient enough to face the wrath of climate change? What will be estimated economic and non-economic effects of climate change on their existence, biodiversity, human-animal conflict, tourism, and livelihood of people directly dependent on these wetlands?
7. What will be the economic effect on agriculture and fisheries in case of wetland degradation and what could be the adaptation or mitigation strategy vis-à-vis food security and sustainable livelihood of the natives?
8. What could be the policy and governance measures for wetland assessment, regulation and management for NE states. Authors may make attempts to link Ramsar Convention agenda with MOEFCC and state efforts to conserve wetlands wealth of NEHR.
9. Can an interdisciplinary team of authors set future research and policy agenda for states and agencies engaged in restoration, conservation and wise use of different types of wetlands in NEHR. Outcome from such studies can also provide directions to state and federal governments to sustain wetland ecosystems.