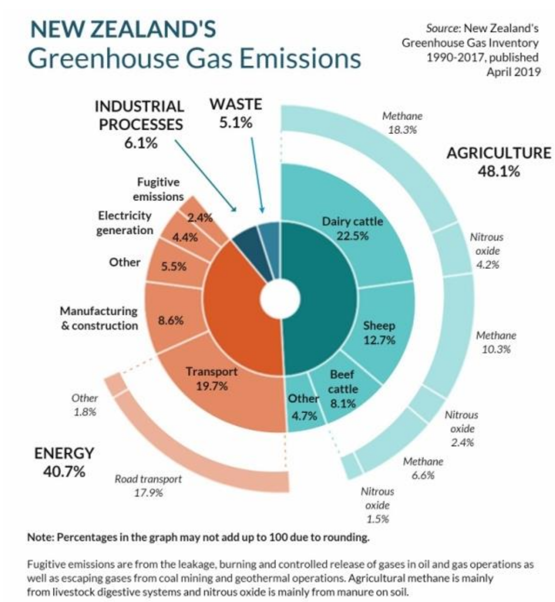
Abstracts of the Presentations of the Speakers in INSAM Webinar on "Climate Action in Agriculture

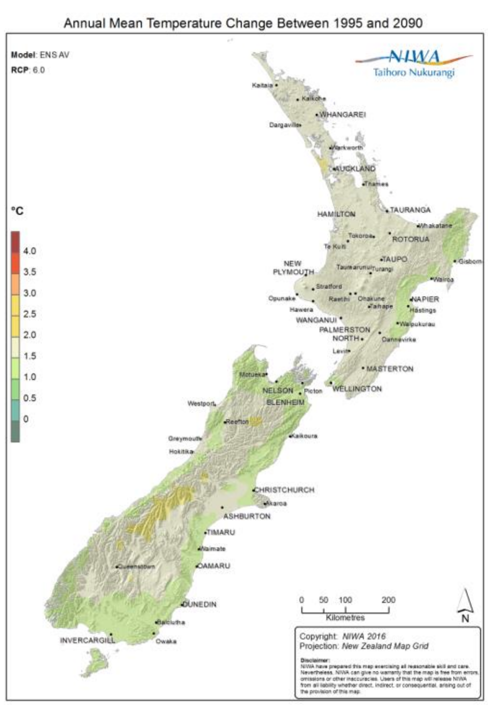
1. **New Zealand Agriculture: Greenhouse gas emissions, adaptation, and mitigation**

Dr Jim Salinger, 2024 New Zealand of the Year, Victorian University of Wellington , Email: jim.salinger@vuw.ac.nz

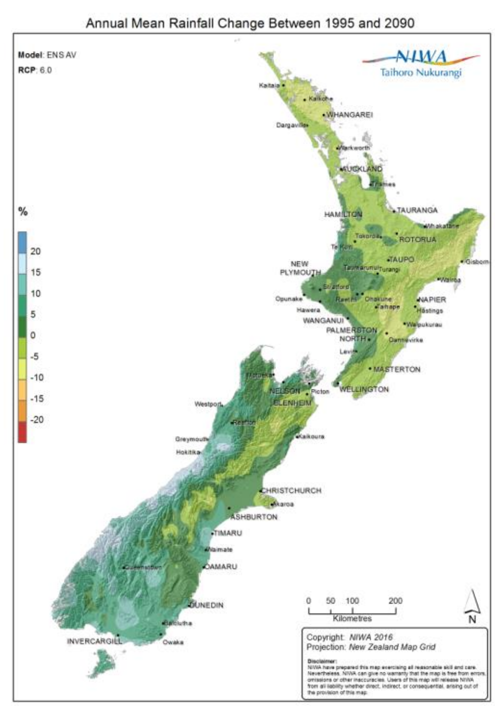
Agricultural industries in New Zealand are a broad mix of small businesses and larger enterprises who produce, process and move more goods around New Zealand and export to more countries across the globe than ever before. Dominant within this are dairy, meat and wool. Ruminant livestock production is very successful based on grass-fed pastures. As well the dominant horticulture is from kiwifruit and winegrapes.



Almost half of New Zealand's CO_2-equivalent greenhouse gas emissions come from agriculture (Ministry for the Environment, 2019). This is a much higher proportion than most other countries – globally, agricultural emissions average around 7.5% of a country's total emissions.Methane (CH_4) accounts for the majority of agricultural emissions in New Zealand and comes mostly from the livestock, such as sheep and cattle. The other main agricultural greenhouse gas, nitrous oxide (N_2O), is produced when nitrogen compounds in urine, manure and fertilisers are broken down by microbes in the soil and released into the atmosphere.

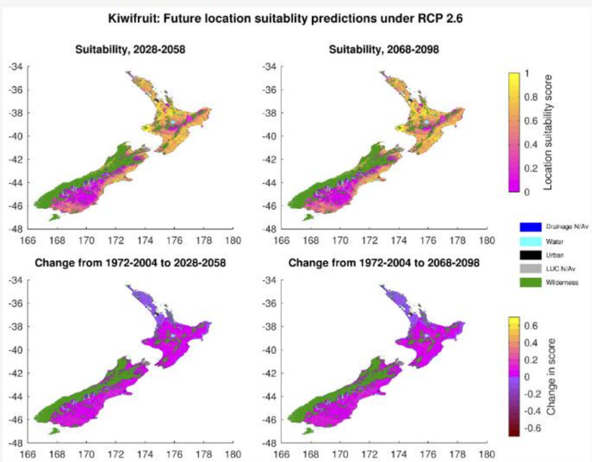


Mid-range climate projections for 2090 show temperature increases of 1.5 ^{o} to 2.0 ^{o}C, and annual precipitation increases of up to 15-20% in the west and south.



Decreases of and decreases of 0 – 10% occur in the north and east. With this frost days decrease, heatwave periods and growing season heat and length increases. Drought periods also increase. For livestock production, ranges spread to higher elevations. The range for kiwifruit production will move southwards, Under RCP 8.5, a very small increase in the area of land with excellent suitability is projected by mid-century, and significant increases in land with suitability scores in the acceptable to very good ranges. However, a loss of 50% of excellent suitability land (10,000 km^2) is projected to occur by the late-century (Vetharaniam et al 2022).

Figure 6. Kiwifruit: projected location suitability (**top** panels) and projected changes in location suitability from the historic period (**bottom** panels) for the mid-century (**left** panels) and late-century (**right** panels) in New Zealand under Representative Concentration Pathway (RCP) 2.6.



As livestock production is the dominant source of greenhouse gas emissions, many efforts have commenced to reduce greenhouse gas emissions. These include feed management, reducing nitrogen use and loss, and planting trees. New initiatives include :

- breeding low-emitting animals
- planting low-emitting crops and using low-emitting feed additives
- methane vaccination to reduce methane production
- methane inhibitors to suppress the methane producing microbes in an animal's gut.
- Alternative manure management treatments to capture or reduce methane from effluent.

As of 2024, the 2050 target is to reduce agricultural CH_4 emissions by between 24 to 47 percent.

Ministry for the Environment, 2019. New Zealand's Greenhouse Gas Inventory. https://environment.govt.nz/assets/Publications/Files/nz-greenhouse-gas-inventory-2019.pdf Vetharaniam, I.; Timar, L.; Stanley, C.J.; Müller, K.; van den Dijssel, C.; Clothier, B. Modelling Climate Change Impacts on Location Suitability and Spatial Footprint of Apple and Kiwifruit. Land 2022, 11, 1639. https://doi.org/10.3390/ land11101639

2. **Impact of climate variability and climate change on enhanced production and quality of fresh produce towards boosting food security**For International Society for Agricultural Meteorology (INSAM) Webinar on Climate Action in Agriculture, 25 May 2024

By

Dr Samsul Huda (S.huda@westernsydney.edu.au), Adjunct Associate Professor, School of Science, Western Sydney University, Australia

Abstract

The presentation covers three aspects a) an outline of climate services and tools in Australia, b) climate and food security research outcomes arising from the collaborative research led by the author and his team, and c) future research needs and some action plan. Climate projections, as outlined in the "The Climate Change Research Strategy (Published 30 June 2022) (https://www.dpi.nsw.gov.au/dpi/climate/about-dpi-climate/climate-change-research-strategy), indicates that in the future, areas of New South Wales (NSW) in Australia are likely to observe decreasing rainfall in winter and spring, increased intensity of extreme rainfall events, day and night temperatures increasing, and fewer frosts. The impact of these on agricultural productivity, water availability, soils and pests/ diseases are addressed to safeguard the future of the regional communities of $17.5 billion sector through resilient and adaptable practices.

Climate variability and climate change play significant role in making smart- decisions towards boosting food security. The domestic agricultural production problems in most countries include: i) adverse climatic conditions, ii) scarcity of water and other inputs, iii) soil health, iv) availability of skilled workforce, and v) infrastructure. In our research, we engage with relevant stakeholders of the local agri-food systems and the supply chain to achieve: i) facilitate best management practices for vegetable/crop production, ii) promote climate-smart agriculture, iii) build human capacity via the training of early career researchers and industry personnel through hands-on workshops in participating countries, iv) develop program and plan to deliver the legacy of the project outcomes for long-term food security in collaboration with collaborating institutes, industries, and the Ministries. Ongoing research projects of the author and the team include i) Enhancing vegetable production and quality in greenhouse and open field conditions in Qatar (Australia and Qatar), Sustainable fertigation for high yield and quality in vegetable protected cropping (Australia and Qatar), iii) Sustainable and resilient future food systems to improve food and nutrition security outcomes (Australia, and GCC countries including Qatar, Oman, UAE). Recently Completed Projects of the author and the team include i) Livelihood improvement through climate-smart agriculture (Australia and India), ii) Improving food security in Qatar (Australia, Qatar and Canada), iii) Safeguarding food andeEnvironment in Qatar (Australia, Qatar and UK), iv) Better understanding constraints to smallholder adoption of agricultural technologies from the perspective of knowledge providers in Cambodia (Australia and Cambodia), v) Food security and climate Change: Evaluating mismatch between crop development and water availability in the Asia-Pacific region (Australia, China and India), vi) The effects of climate change on pests and diseases of major food crops in India, Bangladesh and Australia (Australia, Bangladesh and India). Improved practices arisen from the food security research projects include: i) effective agronomic and soil management practices for crops including high value vegetable crops (e.g., capsicum, cucumber, eggplant,

tomato), ii) better water and nutrient use efficiency in terms of yield and quality in open field production systems and, iii) optimal management practices to maximise fertigation use efficiency in greenhouses.

Future research is built on the outcomes of the food security projects which included i) increased production of high-quality crops, ii) efficient resource management practices, iii) minimum use of water and fertiliser, iv) cost-saving, v) higher return, and vi) reduced environmental pollution. The rapid adoption of the innovative practices developed for crop, soil, water and nutrient management from the food security research projects would go a long way to cope with changing climates including variable water availability. The team works closely with students and staff members of collaborating institutions and other stakeholders to increase their capacity/capability in the agronomy and soil management for protected and open field vegetables. To assess product quality, in general, marketable appearance without pest and disease symptoms are used for laboratory analyses. Fruits of randomly selected plants from each treatment and cultivar are harvested for quality analysis, which includes pH, soluble solids, acidity, colour, and bioactive compounds (e.g., β-carotene, lycopene, ascorbic acid, and total phenolics. Following actions need to be taken to have enhanced good quality food production with improved resource use efficiency i) regular monitoring of the salinity of irrigation water (where appropriate) to ensure that irrigated soils are not salinized; ii) nutrient budgeting to guide fertilizer inputs because the nutrient budgets for field-grown crops identified a mismatch between nutrient inputs and crop demand in current management practices; and iii) soil fertility analyses of extractable phosphorus, organic carbon and exchangeable potassium were identified as key inputs to inform fertilizer management of field crops. Enhancing the supply of safe and nutritious fresh produce to boost food security requires i) Assessing safety and nutritional quality of food from selected food supply sectors with a focus on fresh produce , ii) Evaluating the food supply chain and comparing the nutritional quality and safety of local production compared to imported products, iii) Monitoring adoption rate of improved water and nitrogen management practices and fostering sustainable practices from farm production to consumption of safe and nutritious food through scientific evidence-based policy formulation and government initiatives, iv) Computing the impact of climate change/variability on the emerging food supply chains and future food system, v) Utilizing data-driven insights to customize training programs and capacity-building initiatives for stakeholders, facilitating the effective implementation of policies. Thus future research should address the impact of climate variability and climate change on the agricultural value chain i) Food Supply (Local production, import), ii) Food utilization (processing, storage, preservation); iii) Low quality products into value-added and better nutritious food; iv) Excess production management through drying, processing, v) Food waste (retail and consumer level) including shelf life, over supply, and vi) Consumption pattern (health outcome). Possible actions to achieve the goals and vision include: i) Collaboration among food scientists, nutritionists, agriculture experts, Industry personnel and policymakers to harness the full potential of research efforts in securing a sustainable and resilient food supply, ii) Leveraging scientific advancements, participating countries can take significant strides towards achieving their food and nutrition security goals and ensuring the well-being of their population.

3.Agri-food Systems on Focus

Dr. Andrea Inés Irigoyen, Agrometeorología NACT Física Ambiental (UNMdP) Grupo Recursos Naturales UIB Balcarce Argentina

Climate Actions in Agriculture

An initiative of International Society of Agricultural Meteorology (INSAM)

Increasing climate variability and climate change are reported for Argentina, as over all the world. Climate-related agricultural losses are increasing during last years. The sector faces an increasing complex combination of diverse risks (physical, de transition and liability). Significant pressure has been put on agriculture to ensure food and nutrition security. Climate actions must accelerate rapidly to reach the goal 2030, but just, orderly, and equitable manner. Agronomy science provides key points for climate adaptation with mitigation benefits (Climate Smart Agriculture). The national plan and legal framework reaffirm the commitments. Global Climate Action Portal (GCAP) with reported non-state actors will be displayed to evidence how the efforts are addressed (Mitigation, Adaptation, Finance). Despite an increase in climate finance flows, support for agri-food systems remains behind other sectors. Agroclimate data and services will contribute to build a resilient future.

Climate Action- Indian Perspective

Y.S.Ramakrishna, A.V.M. Subba Rao and M. Prabhakar

Abstract

Climate change is the biggest challenge the world is facing today across all the countries. The sharp increase of GHGs post Industrial period has led to Global warming with a large influence on the atmospheric conditions, climate systems and a continuing increase in mean global temperatures. Currently 2023 records the highest mean global temperature and 2024 is following similar trend with extreme heat wave conditions being experienced in South East Asia in April , while India is experiencing heat wave conditions continuing to date into May 2024. The world realizes that all countries need to act with more attention to quickly tackle the issue of reducing green house emissions and accelerate the transition to renewable energy sources and adopt better climate resilient technologies.

Towards this important objective, the Prime Minister's council on Climate change in India has initiated a National Action Plan on Climate Change (NAPCC) in 2008 to address the climate change concerns comprehensively and launched eight (8) National Missions of which the eighth mission is ' National Misson on Sustainable Agriculture (NMSA). Under this mission a Flagship Project viz; National Innovations on Climate Resilient Agriculture (NICRA) was launched in 2011 under leadership of the Indian Council for Agricultural Research (ICAR) with lead centre at the Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad.

The NICRA program was undertaken across INDIA in 151 climatically vulnerable districts in India (out of 310 vulnerable districts identified) which are adversely affected either by heat waves, cold waves, flood, drought, frost, salinity, cyclones, high rainfall individually or in combinations of these stress factors influencing agricultural production. The research and extension programmes were undertaken by 79 research centres (including 23 Research Institutions) and 172 demonstration units (including 151 Farm Science Centres and 21 research centres) totalling to 251. Modern Scientific equipments like FACE, Plant Phenomics lab with ISI certification were also part of this research programmes envisaged to develop new Rice varieties that are submergence tolerant and those with high NUE, Wheat genotypes with high yield potential and heat stress tolerance to name a few. Similar studies were taken up to enhance resilience in respect of horticultural crops, livestock, poultry and fisheries etc. Climate analogues were also developed for spices to identify new areas suitable for propagation. Measures for adaptation and mitigation of CC impacts through Soil, Water, Nutrient and Energy Use Efficiency and technologies for building soil carbon and improving soil water holding capacity besides enhancing carbon sequestration through Agroforestry systems have been demonstrated to farmers.

Through field demonstrations in the selected cluster villages, Farmers awareness was improved on - climate impacts and measures to be adopted for achieving climate resilient agriculture - under the existing local climate conditions .Towards helping the farming community, 5 measures were adopted viz; Village Climate Risk Management Committee (VCRMC), Custom Hiring Centres for Farm mechanization, Seed Production Systems, Fodder Production Systems and Commodity Based Organizations (CBOs). 18,610 demonstration benefiting 5,15,690 farmers and 20,741 Capacity building programs benefitting 7,07,227 farmers were taken up by the demonstration centers. The total program involved 1200 scientists, 380 research fellows and 160 students and had had achieved significant progress till now. The program is now being extended to other regions in the coming years to create climate resilient agriculture feasible across India.

Besides these national efforts , Social and spiritual organisation like ISHA Foundation headed by Sadhguru has initiated a mass movement for peoples participation in taking up a huge programme of Tree planting under the Slogan ' Cauvery Calling' in Tamil Nadu region of Peninsular India, to revive the river ;Cauvery'. This program which has become progressive since 2019 has enabled planting of 109 million trees across a 1 km width along the river channel to enable better environmental conditions to revive the river flow. The program envisages to enhance the planting to 242 million. This program also encouraged 213,000 farmers to shift to tree based agriculture . Taking inspiration from this social movement, the Government of India has sanctioned 19,000 crores (2.5 billion USD) to revitalize 13 rivers in line with this Rally of Rivers Draft policy recommendation. Presently ISHA Foundation has embarked on ' Save Soil' Campaign In India and this campaign has already been extended to 22 countries across the globe.

In addition to these social activities, the country is also promoting farmers to adopt low input technologies that are environmentally suitable, like Natural Farming (recycling Cow Dung, Urine and bio residues and natural concoctions like Panchagavya, vermi compost, vermiwash) .
Government is also supporting Organic farming and is encouraging some states to become organic by default (Himachal Pradesh).

The country has committed to achieve the Net Zero emissions target by 2070 at the Paris summit. However, looking to the unique GHG profile of India which consists of Carbon Dioxide (48 percent) and Methane (47 percent and Nitrous oxide (5 percent), where methane is nearly half of the emissions. It is now being felt that looking at the progress being made in the country towards building up the renewable resource capacities (India ranks 4th globally for total renewable power capacity additions- 4th in Wind power and 5th in Solar power), Scientists feel that India could try to achieve the Net Zero emission target in a three phased manner, possibly by 2047, to commemorate the centenary (100th year of Independence) of India.