Professor Annamarie Jagose
Provost & Deputy Vice-Chancellor

31 January 2023

Ms Meryl Swanson MP
Chair, House of Representatives Standing Committee on Agriculture
By email: Agriculture.reps@aph.gov.au

Dear Ms Swanson,

Inquiry into food security in Australia

Thank you for the invitation for the University of Sydney to participate in the House of Representatives Agriculture Committee's inquiry into strengthening and safeguarding food security in Australia. We welcome the opportunity to make a submission and trust committee members will find our input useful.

The University of Sydney has a strong and long-standing record of contributing to agricultural innovation and a skilled workforce in Australia, our region and beyond. For more than 100 years we have been a leader in agricultural and veterinary science research, education and industry and regional development partnerships, forging major advances in the productivity, safety and the international reputation of Australia's agricultural expertise, products, services and systems.

We continue to make significant contributions to improving the nation's food security, research capacity and agricultural labour force, particularly (though not exclusively) through the efforts of staff and research students based in our:

- Faculty of Science:
  - Generalist and specialist undergraduate and postgraduate degree programs in agriculture, agroecosystems, plant and animal production, food science, quarantine life science, soil science and hydrology, environmental science, sustainability and more.
  - The Sydney Institute of Agriculture (SIA) - Centre for Carbon, Water and Food and the ARC Industrial Transformation Research Hub - Legumes for Sustainable Agriculture (see both at https://www.sydney.edu.au/agriculture/our-research/research-facilities.html) and also the Institute's research focus on carbon, water and soil.
  - The Sydney School of Veterinary Science, ranked 22 in world, and with broad and globally recognised expertise in research and education across animal welfare, infectious diseases and biosecurity, genomics and genetics.

- Faculty of Arts and Social Sciences:
  - The Sydney School of Economics - extensive education and research in environmental, agricultural and resource economics.

- Faculty of Engineering - Centre for Advanced Food Engineering, the Australian Centre for Field Robotics and The Warren Centre.

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We would be happy to discuss our attached responses to your inquiry's terms of reference with the Committee and provide more information on any relevant research projects that our staff and partners are currently undertaking.

Should the Committee wish to hear further from our experts, in the first instance please do not hesitate to contact Professor Brent Kaiser through Claire Kennedy, the SIA's Executive Officer at claire.kennedy@sydney.edu.au or (02) 8627 1003.

Yours sincerely,

(signature removed)

Professor Annamarie Jagose
Acting Vice-Chancellor

Attachment University of Sydney submission to the Parliamentary inquiry into food security in Australia, January 2023

THE UNIVERSITY OF SYDNEY

University of Sydney submission to the Parliamentary inquiry into food security in Australia, January 2023

TOR1 - National production, consumption and export of food

Australia has a remarkable ability to produce reliable high-quality food that can comfortably meet domestic requirements, while also contributing to the expanding international demand for protein, carbohydrates and fibre. Our role in global food supply chains is internationally recognised; highlighted by quality and in many cases quantity of product that meets underlying domestic and international demand. We have the capacity to continue delivering exceptional foods and fibre for decades to come. However, our national ability to do this will increasingly be reliant on our capacity to continue developing new production technologies that offer greater environmental resilience, alongside processes that protect biodiversity, and activities that deliver sustainable outcomes. Each of these areas is increasingly under threat because of human-induced climatic change and our response will require an expanded stable, knowledgeable and skilled workforce.

The rising level of greenhouse gases in the atmosphere has an impact on environmental patterns and intensities, where drought, heat, flooding and wind reduce production certainty. These are pressures not just experienced by Australian producers but are seen globally across food producing nations - resulting in major challenges and shocks to global food exchange. Our position in the global food web needs to be secured to support domestic demand but also offer product on global markets. This will require a concerted effort to transform traditional practices to approaches that can tolerate rapid environmental change while still growing production capacity.

Food consumption and food choice has been a hallmark of modern Australian agriculture. The wide range of food demands and changing consumption patterns have diversified the production systems in Australia. We now enjoy foods of most types being produced in Australia across the vast landscape and environmental allowance the continent provides. Our consumption of the production potential is still limited by sheer population size, where estimates of 70 million people can be fed by the products we produce domestically. To enjoy the economies of scale that agricultural production relies upon, our production systems and our food chains will continually point towards overseas markets where vast populations are quickly being concerned about food supply, quality and security. This export-driven system can reach new levels with a re-focus on value-adding of the primary products we produce and the distribution to markets seeking high-quality products, e.g., pork or milk/dairy (especially baby formula or cheese). Our historical reliance on the export of raw commodities is fragile based on our size, the level of production and the vulnerability of supply. Often a ‘price taker’ rather than a ‘price setter’, our ability to maximise value will rely on onshore value enhancement prior to export of finalised products that attract much more value. For example, alternate protein flours used in the alternative food sector are all imports from external countries, fetching up to $8,000 per tonne of product. Raw grain used to make plant flours often sells for less than $600 per tonne. In the pulse sector, we produce around 2.5 million tonnes of pulse seeds in Australia but still rely solely on imported pulse flours to produce foods in Australia.

Technology driven solutions

Technology is key to Australia’s continued food system capacity. Primary production requires continual advances in technology solutions to aid productivity under decaying conditions (drought, heat, land decay, disease and urban pressure). The impact of climate change is transforming the landscapes we are familiar with, faster than genetic gains can be achieved in both plant and animal systems. We are effectively running behind the curve of change.

For the most part, our current production practices increasingly utilise advanced technologies to ensure production and quality is maximised across the food, fibre and beverage sectors. Technological inputs and their discovery programs need to continue as a necessary long-term

investment to manage the increased complexity and challenges that are developing as production systems deteriorate with human-influenced change. Our production backbone is currently being challenged by a multitude of diverse impacts caused by climate change. This includes increased exposures of drought, flood, heat and disease, which have a direct impact on primary production. In parallel, management of the production system is becoming more fragile with social engagement waning and knowledge and appreciation of the food system a distant thought to most Australians. Along with understanding carbon management and policy direction, each of these factors influence market sustainability and the financial resilience of the agriculture and food sectors.

In particular, our use of land (soil management and conversation), our inputs (water, fuel, seeds, animal herds, disease and weed management) and social connectivity (regional employment, community integration and support) are key areas that sustainable national production will rely on to continue.

Universities have an important part to play, where cross-disciplinary approaches using skills and advances in other areas need an explicit transfer to agricultural-focussed solutions. The importance of this investment must be re-calculated and equated to other areas, such as medicine and health, engineering, economics and finance. Food security will be dependent on technology advances; key programs that require a greater awareness of and elevated priority for the nation.

TOR2 - Access to key inputs such as fuel, fertiliser and labour, and their impact on production costs

Agriculture in Australia has followed other industries and relied on overseas inputs to lessen costs and ensure productivity and profitability can be maximised. This has made Australian agriculture heavily exposed to external influence (supply of fertilisers, technologies, transport, labour, knowledge). Domestic supply of key inputs should be placed as a high priority to ensure the robustness and resilience of the sector and the ability to adapt to change and priorities. Food and fibre are relatively cheap to Australian consumers and the previous models, which drive prices downwards on the back of decreasing sustainability, will end poorly for the nation. A single disruption in urea supply would cripple all of Australia's grain production capacity and influence other sectors to suffer significant challenges in their ability to produce. Alternative and technology driven production systems offer opportunities to re-position input dependencies and secure capacity more resilient to environmental, economic and political influence.

TOR3 - The impact of supply chain distribution on the cost and availability of food

Australia's experience with COVID-19 and the preceding devastations wrought by bushfires and floods have exposed the glaring unpreparedness of our essential supply chains in the face of unanticipated disruptions. Essential supply chains provide the goods and services that support the basic needs of Australians (e.g., food, water, and health services). Australia's food supply chains rely on material/service supply from across the globe, for example, the Wesfarmers Group in Australia has over 3,000 suppliers located in more than 40 countries. This complex network of economic interdependencies means that supply chains are exposed to several types of risks. Yet, surprisingly, our industries have been considerably less focused on developing more resilient food supply chains than their overseas counterparts. With continuing geopolitical instability and accelerating climate change, having resilient and sustainable food supply chains is essential for Australia's economic and national security.

The effectiveness and resilience of our food supply and distribution depend upon the architecture/structure of the supply chains, for example, relying on a single supplier, or sourcing from a single region, or relying on a single mode of transport are related to the structural characteristics of a supply chain. It is not economically viable, however, for our food supply chains to invest in all strategies for effective and resilient supply of food. For example, the risk of single-sourcing (i.e., relying on a single supplier for the supply of a product/service) can be mitigated through supplier diversification (i.e., having suppliers in different geographical locations so that a single event will not affect all suppliers at the same time or in the same magnitude). Unfortunately, multi-sourcing entails costs due to reduced quantity discount when buying from multiple suppliers, and the complexities of monitoring the performance of all suppliers, therefore, systematic cost/benefit trade-offs must be made to identify the most suitable strategies to capitalise on for building effective, resilient and sustainable food supply chains. We need customisable AI-powered tools and decision systems to

make these trade-off decisions and empower our food industries to confidently, reliably and flexibly restructure their supply chains to build resilience in preparation for future shocks, and to maintain their productivity and service levels in the face of disruptions.

The first step in developing such decision tools is a thorough understanding of the risk appetite, tolerances and thresholds of our Australia's food industry. Risk appetite is the high-level description of the overall risk-taking attitude of an industry, defined as the degree of risk an industry is willing to accept in anticipation of a reward. Risk tolerance is the percentage or volume of particular risks that an industry can withstand. Risk threshold is the next step up from risk tolerance; defined as the level beyond which the industry cannot endure the risk. Once we can quantify the risk appetite, tolerances and thresholds of our food supply chains, we can develop customisable supply chain design/planning models to help our food companies to make effective trade-off decisions to identify investment opportunities, thereby restructure their supply chains for effective, resilient and sustainable food supply and distribution in Australia.

TOR4 - The potential opportunities and threats of climate change on food production in Australia

Supply chain coordination with primary production capacity is an 'Achilles heel' to Australian agriculture growth, profitability, and resilience. The industry is very much segmented and often in competition with other industries (transport and freight) resulting in some global advantages being undermined. The melding of primary production with manufacturing and value-added opportunities is the key to a more productive, profitable and resilient agricultural sector. Processes need to be in place to allow for the transport of primary goods, their processing and manufacturing into foods, and the coordinated distribution and sale to consumers in Australia and overseas. Climate change has immediate impact on the traditional primary production systems, while the lack of downstream food systems further lessens Australia's food resilience to these continuing changes.

We provide below a sample of University of Sydney researchers expert in drought and risk management; climate change adaptation; climate disaster, and disaster management. We would be happy to provide more information on these or other projects for the benefit of the House Standing Committee on Agriculture and/or to organise roundtables and one-on-one meetings with these and other experts if that would be of interest.

DROUGHT & RISK MANAGEMENT

• **Sydney Institute of Agriculture**.
Key contacts: Professor **Brent Kaiser** (Director) and Professor **Alex McBratney**
Leading basic and applied research in soil, carbon, water, climate and agriculture, drought and risk management, and ag tech.
See detailed research capabilities statements on:

- Drought and Risk Management
- Building the Farm of the Future
- Digital Farm
- Future Food
- Plant Genetic Technologies
- Soil: digital mapping, modelling and assessment
- Livestock Production
- Animal Health and Welfare

CLIMATE CHANGE ADAPTATION

• **Sydney Environment Institute**. Key contact: Professor **David Schlosberg** (Director)
Very strong research capacity on climate change adaption, community engagement, and transition to low carbon economy. The Sydney Environment Institute also serves as a general convenor of climate change expertise across the University, including in climate disaster and adaptation.

PLANNING
• Professors **Robyn Dowling** and **Nicole Gurran**, Sydney School of Architecture, Design and Planning
Broad expertise on energy policy and measurement. Professor Gurran has very strong expertise working with councils on preparing for climate change (eg. NSW and Victorian coastal councils).

WATER
• Professors **Martijn de Sterke** and **Chiara Neto,** Faculty of Science, Sydney Nano Institute Advanced Capture of Water from the Atmosphere (ACWA) - using nanotechnology to develop a low-cost method to capture water from thin air. With laboratory proof-of-principle methods in progress, Professors de Sterke and Neto are looking to upscale this approach to develop large surfaces that can passively capture water condensation and turn it into a stable water supply for Australian produce. This can become a low-cost mitigation and adaptation technology for drought-affected areas.

AGRICULTURE, RESOURCE, ENVIRONMENTAL AND DEVELOPMENT ECONOMICS

The Sydney School of Economics, academic staff including:

- Tiho Ancev
- Shyamal Chowdhury
- Valentina Duque
- Alastair Fraser
- Hugh Harley
- Chandana Maitra
- Shauna Phillips
- Matthew Smith
- Rebecca Taylor
- Russell Toth
- David Ubilava
- Jordi Vidal-Robert
- Huy Vu

CLIMATE DISASTER & ENVIRONMENTAL LAW

• **Australian Centre for Climate and Environmental Law.**
Key contact: Professor **Rosemary Lyster** (Director), Professor of Climate and Environmental Law, Sydney Law School
Expert on climate disaster law and environmental law.

DISASTER MANAGEMENT - ANALYTICS

• **ARC Centre Data Analytics for Resources and Environments (DARE)**.
Key contact: Professor **Willem Vervoort**
The DARE Centre is a collaborative research centre led by the University of Sydney in partnership with the University of New South Wales and the University of Western Australia and funded under a five-year grant from the Australian Research Council in partnership with industry and government. DARE's partner organisations represent some of the nation's leading organisations directly involved in natural resource use and management. DARE will develop and deliver the data science skills and tools for Australia's natural resource industries and managers; to be expert users of data and models; to quantify, explain and understand uncertainty; and to make the best possible evidence-based decisions in exploiting and stewarding the nations' natural resources and environment.

• Professor **Manfred Lanzen**, Chair Sustainability Research, School of Physics, Faculty of Science
The **Integrated Sustainability Analysis (IAS) team** in the School of Physics has expertise in methods that quantify the spill-over effects of a disaster on economies, jobs, livelihoods beyond the regions or segment of the economy directly hit or affected. Such information is vital for contingency planning, and strategic hedging of supply-chain networks, in order to ensure there is maximum resilience built into the system.