University of Southern Queensland

PhD Opportunities

with the

Agricultural Systems Modelling Group

Centre for Sustainable Agricultural Systems

Institute for Agriculture, Climate and the Environment

University of Southern Queensland

Application Booklet

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1 Centre for Sustainable Agricultural Systems

The Centre for Sustainable Agricultural Systems conducts internationally leading research to deliver practical solutions for the sustainable management of complex agricultural enterprises and agroecosystems.

The Centre addresses key agricultural and environmental challenges at local, national and global scales, with the goal of delivering multifunctional landscapes that conserve and sustain our natural resources, whilst providing enhanced productivity.

Photo: Prof. Keith Pembleton – Director of the Centre for Sustainable Agricultural Systems

Centre researchers assist decision-makers to diagnose system constraints and make informed decisions that improve productivity, profitability and environmental sustainability; address problems and capitalise on opportunities; and analyse, develop and implement policies, practices and designs.

The centre comprises three research groups on *Agricultural Systems Modelling*, *Sustainable Agroecosystems*, and *Wildlife Management*. The PhD opportunities advertised here are within the *Agricultural Systems Modelling Group*.

2 About the PhD opportunities

We are offering the following diverse PhD opportunities, providing an exceptional chance to develop expertise in the analysis of agricultural systems, rural development and agricultural economics while building the skills needed for a successful career in research, industry, or government.

2.1 Current trends and future prospects for the sustainability of oil palm production systems

2.1.1 Research topic description

Palm oil is a major global vegetable oil with a diverse set of commercial uses for both food consumption, biofuels and further industrial purposes. Over the past two decades, oil palm has been one of the fastest expanding agricultural crops worldwide, with the largest increases in cultivated area occurring in Southeast Asia. Recently, the pace in global oil palm area expansion has considerably slowed. However, future increases in demand and commodity prices could reverse this trend, potentially driving renewed expansion of oil palm cultivation and associated land-use change. Should such expansion occur, it may extend beyond the current production centres in Southeast Asia into emerging production regions, including parts of Latin America and Sub-Saharan Africa.

The expansion of oil palm production systems has been widely documented to result in a range of significant environmental and social sustainability impacts. These include deforestation and habitat loss, biodiversity decline, greenhouse gas emissions associated with land-use change and peatland drainage, soil and water degradation, air pollution associated with forest and peat fires used for land clearing, and a range of social concerns, including land tenure conflicts, labour rights violations, and inequitable distribution of economic benefits. Many of these sustainability concerns have entered public discourse through high-profile campaigns by organisations such as Greenpeace, the World Wide Fund for Nature, Friends of the Earth, and Amnesty International.

In order to monitor and improve the sustainability performance of oil palm production systems, a large number of sustainability initiatives and international projects have been established. These include certification schemes, sustainability monitoring frameworks, jurisdictional approaches, corporate zero-deforestation commitments, and international research partnerships. Some well-known examples include the Roundtable on Sustainable Palm Oil, the High Carbon Stock Approach, the High Conservation Value Resource Network, the Tropical Forest Alliance, and national certification systems such as the Indonesian Sustainable Palm Oil and Malaysian Sustainable Palm Oil standards. All existing sustainability initiatives have been subject to their own sets of criticism.

Despite these negative outcomes of palm oil production systems, they have also led to a sizeable generation of economic value across Malaysia and Indonesia. Among the major vegetable oil crops, oil palm has by far the highest oil yield per unit of land. This may reduce the total amount of land required for any given global consumption requirement, thus contributing to land sparing. Many existing plantations continue to operate below attainable yield levels. Whether these yield gaps can be sustainably closed under current market conditions remains an open question, as does the identification of the agronomic, economic, and institutional factors that enable sustainable intensification.

Against this background, it is of high relevance to conduct a data-driven and comprehensive empirical assessment of the current trends in the sustainability outcomes of major palm oil production systems. Building on such a stocktaking, what are the major sustainability deficits that can feasibly be improved in the current market and institutional environment? Are there clear recommendations and field-level actions that would contribute to a more sustainable intensification of existing palm oil plantations? Do conclusions strongly vary between smaller and larger land sizes? Are there any lessons learned for countries and continents that may observe an increase in cultivated oil palm area in the future?

The APSIM Oil Palm model provides a quantitative framework for evaluating current production systems across a wide range of biophysical outcomes and for assessing future production scenarios. Robust model application requires access to high-quality data from agronomic field trials for model calibration and evaluation. Such work may identify opportunities for model revision and improvement, enable the calibration of additional cultivars relevant to different national and regional contexts, and improve the representation and documentation of the diverse management practices that characterise contemporary oil palm production systems. To ensure the relevance of these analyses, model development and parameterisation should also be informed by farm-level survey data. Such data are essential to link simulation scenarios to real-world production conditions and to adequately capture the diversity of oil palm production systems, including differences between smallholder systems and large-scale commercial plantations. Scaling these analyses to regional and national levels requires integration with gridded datasets describing climate, soils, land use, and other relevant environmental variables.

2.1.2 Likely research activities & methods

- Application of the APSIM palm oil model
- Systematic crop model calibration and evaluation
- Understanding of the APSIM Plant Modelling Framework
- Comprehensive, multi-dimensional sustainability assessments
- Understanding of the major palm oil cropping systems in selected countries
- Analysis of economic trends and outlooks
- Acquisition, management and basic analysis of micro datasets and regional data on palm oil production
- Acquisition, management and basic analysis of remote sensing data
- Thorough command of selected scientific scripting languages (Python/R) and acquisition of further scripting skills as required (C#)

2.1.3 Future career opportunities

- Researcher in agricultural systems, crop modelling, sustainability science, or international development (universities, CSIRO, CGIAR centres, etc.)

- Government scientist or policy advisor in agriculture, environment, climate change, land use, or natural resource management
- International development specialist working for NGOs, donor agencies, or international organisations (e.g. FAO, IFAD, World Bank, ACIAR)
- Sustainability or ESG advisor for agricultural companies, commodity traders, certification bodies, or consulting firms
- Agricultural systems modeller or data scientist in agritech companies, agricultural consultancies, or research organisations
- Supply chain sustainability specialist supporting sustainable sourcing, traceability, and zero-deforestation commitments within the palm oil or broader agricultural sector

2.2 Poverty reduction through education? Empirical evidence on the impact of educational expansion in Sub-Saharan Africa

2.2.1 Research topic description

Sub-Saharan Africa has experienced one of the fastest educational expansions globally over the past five decades. Primary education has moved from being accessible to a minority of children toward near-universal access in many countries, while secondary and tertiary education have undergone rapid massification since the 1990s. However, this expansion has been accompanied by persistent challenges in education quality, completion rates, teacher availability, and labour-market alignment. This educational expansion is also closely linked to the broader demographic transition in SSA: a much larger young population is now entering school-age cohorts, so education systems have had to expand not only in percentage terms but also in absolute numbers.

The economic returns to education represent a classical and very extensively studied topic in economics and econometrics. A large body of empirical research has examined how additional years of schooling affect individual earnings, labour market outcomes, productivity, and broader economic development. Seminal contributions, such as the human capital framework developed by Gary Becker and the widely used econometric approach proposed by Jacob Mincer, established education as an investment that generates measurable economic returns. Subsequent research has estimated returns to education across countries, genders, sectors, and levels of development, while addressing methodological challenges such as ability bias, selection effects, and the potential endogeneity of educational attainment. More recent studies have extended this literature by examining the quality of education, differences in returns across fields of study, and the role of education in fostering innovation, social mobility, and long-term economic growth.

In low- and middle-income countries, particularly in Sub-Saharan Africa, research on the returns to education is central to understanding pathways for poverty reduction, structural transformation, and economic development.

With the expanded availability, scope, and quality of micro-, meso-, and macro-level (survey) data across Sub-Saharan Africa in the recent decade, it is now more feasible to investigate specific sub-aspects of the impact of the educational expansion across the continent.

Relevant questions include whether the benefits from education strongly vary across countries/sub-national regions and which determinants or interacting factors may be driving such differences. Widely considered hypotheses include a differential benefit from (i) primary, secondary, and tertiary education, (ii) the quality of the education provided (including teacher-student ratio; curriculum content and structure), (iii) the presence and proximity to relevant employment opportunities (urban-rural divide; service-sector economy), and many other hypotheses at micro-, meso-, and macro-level.

2.2.2 Likely research activities & methods

- Econometric analysis of educational outcomes and poverty dynamics
- Analysis of micro-, meso-, and macro-level survey datasets
- Panel data analysis and causal inference methods

- Impact assessment and policy analysis
- Integration of socio-economic and geospatial datasets
- Statistical analysis and visualisation using Python and/or R
- Comparative analyses across countries, regions, or population groups
- Evidence synthesis and literature reviews

2.2.3 Future career opportunities

- Researcher in development economics, education economics, poverty analysis, or international development (universities, research institutes, CGIAR centres, etc.)
- Economist or policy advisor in government agencies responsible for education, labour markets, economic development, or social policy
- International development specialist working for NGOs, donor agencies, or international organisations (e.g. World Bank, UNICEF, UNESCO, ILO, ACIAR)
- Monitoring, evaluation, and learning (MEL) specialist supporting evidence-based development programmes
- Economist, data scientist, or quantitative analyst in consulting firms, think tanks, or research organisations
- Evaluation specialist conducting impact assessments of education, poverty reduction, and social development programmes

2.3 Demand-side drivers of agricultural growth and structural transformation in Sub-Saharan Africa

2.3.1 Research topic description

Agriculture remains the largest source of employment across much of Sub-Saharan Africa and is therefore central to efforts aimed at reducing poverty, improving food security, and stimulating broader economic development. Increasing agricultural productivity is widely recognised as a prerequisite for structural transformation, enabling labour and capital to move into higher-productivity sectors while simultaneously supporting rising rural incomes. Total and partial factor productivity and their growth rates remain low in agriculture across Sub-Saharan Africa. However, national-level statistics may obscure substantial spatial heterogeneity.

One long-standing hypothesis in agricultural and development economics is that agricultural intensification is primarily driven by demand-side factors. The seminal work by Esther Boserup suggests that increasing population density, improved market access, and expanding consumer demand create incentives for farmers to adopt more intensive production systems, invest in new technologies, and increase land productivity. While this hypothesis has shaped development thinking for decades, empirical evidence remains mixed and appears to vary considerably across countries and farming systems.

Physical and institutional market infrastructure (road and transport networks, trade agreements and liberalisation, etc.) has significantly expanded across many production locations in SSA over recent decades. Further, many countries are experiencing a major population expansion. Both dynamics have meant that demand-side incentives for agricultural production, for both domestic and export markets, have increased.

According to the classical Boserupian hypothesis, stronger demand-side incentives should encourage agricultural intensification by increasing the expected returns to investments in improved technologies, inputs, and management practices. However, whether these incentives have translated into measurable improvements in agricultural productivity remains an open empirical question. It is equally unclear if some regions or farming systems appear to respond more receptively to demand-side incentives.

These developments provide a unique opportunity to revisit one of the central questions in agricultural and development economics: To what extent is agricultural growth driven by demand-side incentives, and under what conditions do these incentives translate into agricultural intensification, structural transformation, and ultimately poverty reduction?

This thesis investigates the extent to which agricultural productivity and its growth trajectory vary across production locations and farming systems in Sub-Saharan Africa. Using econometric techniques and appropriate household-, plot-, or regional-level panel datasets, the research examines how demand-side factors influence total factor productivity. The research may focus on a selected country or employ a comparative cross-country perspective, depending on the availability of suitable data and the specific research question. Potential indicators of market demand include proximity to markets, population centres, road infrastructure, and other measures of market connectivity.

A key methodological challenge will be the identification of the effects of demand-side drivers on agricultural productivity. Many of the variables of interest, such as market access, infrastructure development, and population density, may themselves be influenced by agricultural productivity or by unobserved factors affecting both.

In particular, reverse causality represents an important concern: for example, while higher population density may stimulate agricultural intensification by increasing demand pressures, more productive agricultural regions may also attract and sustain larger populations (i.e., higher pull factors and lower push factors than in low-productivity locations). Similarly, while improved road infrastructure may enhance agricultural productivity due to better market access, governments may prioritise the development of infrastructure in regions with greater existing economic potential. Distinguishing potential effects of demand-side drivers from spurious associations, therefore, represents a central component of the research and will require careful consideration of appropriate identification strategies and econometric methods.

2.3.2 Likely research activities & methods

- Analysis of household-, plot-, regional-, or national-level panel datasets
- Application of panel data methods and causal inference approaches
- Econometric analysis of agricultural growth and structural transformation
- Agricultural productivity measurement and decomposition (e.g., total and partial factor productivity analysis)
- Spatial analysis of agricultural production systems and market connectivity
- Integration of socio-economic, agricultural, infrastructure, and geospatial datasets
- Analysis of market access, population dynamics, infrastructure development, and other demand-side drivers
- Statistical analysis and visualisation
- Thorough command of selected scientific scripting languages for statistical analyses (Python/R)

2.3.3 Future career opportunities

- Researcher in agricultural economics, development economics, rural development, or food systems (universities, research institutes, CGIAR centres, etc.)
- Economist or policy advisor in government agencies working on agriculture, rural development, food security, or economic transformation
- International development specialist working for NGOs, donor agencies, or international organisations (e.g. World Bank, FAO, IFAD, ACIAR)
- Monitoring, evaluation, and learning (MEL) specialist supporting evidence-based development programmes
- Data analyst, economist, or quantitative consultant in consulting firms, think tanks, or research organisations

2.4 Quantifying the welfare costs of environmental stress and degradation: A spatial econometric approach

2.4.1 Research topic description

Environmental resources play a central role in determining the economic opportunities and welfare outcomes of rural populations. In many rural regions, households remain highly dependent on natural resources and agricultural production systems that are directly exposed to climate variability, droughts, land degradation, and other forms of environmental stress. Understanding how environmental changes affect rural livelihoods is therefore critical for designing effective strategies for socio-economically viable rural areas and sustainable resource management.

Historically, empirical assessments of environmental degradation and climate shocks have often been constrained by limited spatial and temporal data availability. However, recent advances in remote sensing, gridded environmental datasets, and the increasing availability of georeferenced socio-economic survey data now enable more detailed investigations of how environmental conditions shape human welfare across space and time.

This thesis will investigate the welfare costs associated with environmental stress and/or degradation using spatially explicit econometric approaches. The research will initially identify spatial and temporal patterns in which environmental pressures, such as drought occurrence or land degradation, are associated with changes in income, expenditure, agricultural outcomes, or other welfare indicators. Building on this descriptive analysis, the research will investigate why similar environmental pressures result in different welfare outcomes across locations and population groups.

A key research question is why some communities appear more vulnerable to environmental stress than others. Potential explanations may include differences in agricultural systems, market access, infrastructure, institutional conditions, livelihood diversification, or access to adaptation opportunities. The research will therefore contribute to a better understanding of the mechanisms through which environmental conditions translate into socio-economic consequences.

The project will require the identification and use of suitable georeferenced microdata from an appropriate case study region (potentially Australia or a low-income country from Sub-Saharan Africa, Asia, or Oceania). The analysis will combine socio-economic survey data with spatial environmental datasets and may involve panel data methods, spatial econometrics, and other quantitative approaches.

2.4.2 Likely research activities & methods

- Econometric analysis using panel data methods and a comprehensive application of spatial econometrics
- Acquisition and management of geo-spatial environmental data (including remote sensing products as necessary)
- Quantitative assessment of environmental stress and rural welfare outcomes
- Identification and analysis of factors affecting adaptive capacity and resilience

- Statistical analysis, data visualisation, and reproducible research workflows using Python and/or R

2.4.3 Future career opportunities

- Researcher in environmental economics, climate adaptation, rural development, sustainability science, or agricultural systems (universities, research institutes, CGIAR centres, etc.)
- Government scientist or policy advisor in climate adaptation, natural resource management, environmental policy, or rural development
- International development specialist working on climate resilience, poverty reduction, and sustainable livelihoods (e.g. World Bank, FAO, IFAD, GIZ, NGOs)
- Environmental or sustainability consultant supporting climate risk assessments, adaptation strategies, and evidence-based decision-making
- Spatial data analyst, geospatial scientist, or quantitative researcher in environmental, agricultural, or development organisations
- Monitoring, evaluation, and learning (MEL) specialist assessing the impacts of climate, environmental, and development interventions

2.5 A protocol for multi-site crop model calibration

2.5.1 Research topic description

Crop simulation models have become indispensable tools for agricultural research and policy. They enable researchers to quantitatively predict how changes in crop management, production systems, environmental conditions, and genetic characteristics are likely to affect crop growth, resource use, and productivity. By complementing and extending agricultural field experiments, crop models allow thousands of production scenarios to be investigated across diverse soils, climates, and management systems. In doing so, they provide an evidence base for identifying promising management interventions, prioritising future agronomic research, assessing the likely impacts of agricultural innovations, and informing agricultural and environmental policy.

Over the past few decades, the availability of gridded meteorological, soil, and other environmental datasets has expanded dramatically. These developments have created new opportunities to apply crop simulation models across large geographical areas using gridded modelling approaches, while also enabling site-specific, on-demand simulations for precision agriculture and agricultural decision support.

Traditionally, crop simulation models have been developed and applied using site-specific calibration and evaluation based on local experimental data. This workflow has provided confidence in model performance but is difficult to scale to national or continental applications. At the same time, the rapid expansion of high-resolution weather, soil, and land-use datasets has made large-scale gridded crop modelling increasingly feasible. Whether such applications remain scientifically defensible without extensive site-specific calibration, and which alternative calibration strategies can ensure robust model performance across diverse environments, remain largely unresolved methodological questions.

The past decade has seen increasing formalisation of methodological procedures for crop model calibration. Most notably, the AgMIP initiative has contributed significantly to the development of a general calibration protocol and is supporting its operational implementation through dedicated open-source software.

The increasing availability of agricultural experimental datasets from multiple locations has fundamentally changed how crop models are applied. Rather than calibrating models for individual experimental sites, researchers increasingly seek model parameterisations that perform well across diverse environments, management systems, and climatic conditions.

However, neither the AgMIP calibration protocol nor other major contributions provide explicit guidance on the key challenges or best practices associated with multi-site crop model calibration. Questions remain regarding parameter identifiability, weighting of sites, treatment of heterogeneous datasets, transferability of parameter estimates, and appropriate evaluation strategies.

This thesis will compile and utilise agricultural experimental data from multiple sites to conduct a systematic evaluation of different approaches to multi-site crop model calibration. The candidate will develop a comprehensive conceptual assessment of the statistical implications involved and, ultimately, produce a practical guidance protocol for conducting multi-site crop model calibration.

2.5.2 Likely research activities & methods

- Gridded crop simulation modelling using APISM, including extensive model calibration and evaluation
- Thorough understanding of the APSIM modelling environment and the Plant Modelling Framework
- Statistical methods for parameter estimation, uncertainty analysis, and model evaluation
- Comparative evaluation of alternative crop model calibration strategies
- Comprehensive application of resampling techniques
- Acquisition and usage of agricultural experimental datasets across diverse environments
- Statistical analysis and data visualisation using Python and/or R
- Development of methodological guidelines and reproducible scientific workflows

2.5.3 Future career opportunities

- Research scientist in crop modelling or environmental modelling (universities, CSIRO, CGIAR centres, etc.)
- Government scientist or modeller supporting agricultural policy, water resource management, natural resource management, or environmental compliance
- Environmental or sustainability consultant conducting environmental impact assessments, sustainability assessments, climate risk analyses, or natural resource management studies
- Agricultural systems modeller developing digital agriculture technologies, farm decision-support tools, and precision agriculture applications for agritech companies
- Crop modeller supporting plant breeding programmes, genotype evaluation, and cultivar development in the seed industry
- Climate risk analyst assessing the impacts of climate variability and climate change on agricultural production, natural resources, or food systems for the insurance or finance industry

2.6 Gridded cropping systems modelling for large-scale assessments

2.6.1 Research topic description

Large-scale biophysical assessments at national and continental scales are of central importance for informing agricultural and environmental policy-making. When the conditions of agricultural production structurally change – for example due to price shocks to fuel and fertiliser, new environmental regulations, climate change, or changing social expectations towards more sustainable and multi-functional agriculture – government and industry stakeholders require scientific scenario analyses that evaluate how agricultural systems can adapt to such new conditions.

Crop simulation models provide a quantitative framework for conducting such assessments. Applied across large geographical areas, they can help identify promising crop management strategies, prioritise public research and investment, evaluate climate adaptation options, assess environmental sustainability, and estimate the likely impacts of alternative agricultural policies.

Until recently, such assessments were constrained by limited data availability and computing capacity. Over the past two decades, however, the availability of high-resolution gridded datasets describing weather, soils, land use, and increasingly also crop management has expanded dramatically. Together with advances in computational capacity and crop modelling software, these developments have made it increasingly feasible to simulate cropping systems consistently across entire regions, countries, and continents.

Applying crop simulation models across such large spatial scales nevertheless introduces important methodological challenges. Unlike traditional applications based on well-characterised experimental sites, gridded assessments frequently rely on heterogeneous environmental datasets and limited site-specific calibration. These limitations require careful consideration when interpreting model outputs, but they do not diminish the considerable potential of large-scale crop modelling as a tool for agricultural research and policy analysis.

Building on these methodological foundations, this PhD focuses on the application of gridded crop modelling to answer important research questions in farming systems research at regional, national, or continental scale. Depending on the interests of the candidate and available datasets, the project may investigate topics such as the suitability of changes to cropping systems or strategies, sustainability assessments, drought resilience, quantification of environmental impacts as well as socio-economic outcomes (e.g., gross margin), local and regional nutrient cycling, opportunities to improve resource-use efficiency, assessing adaptation strategies to future climate change, etc.

2.6.2 Likely research activities & methods

- High-resolution gridded simulation of cropping system scenarios using APSIM
- Acquisition and management of large-scale, high-resolution geospatial data
- Thorough understanding of the APSIM crop model and command to represent advanced cropping system scenarios using C#
- Assessment of trade-offs and synergies of cropping system scenarios across a range of relevant outcome indicators (productivity, profitability, sustainability, resilience)

- Thorough analysis of large-scale crop simulation outputs across diverse production environments
- Statistical analysis and data visualisation using Python and/or R

2.6.3 Future career opportunities

- Research scientist in agricultural systems modelling, crop modelling, climate adaptation, or sustainable agriculture (universities, CSIRO, CGIAR centres, etc.)
- Government scientist or policy analyst supporting agricultural strategy, climate adaptation, or natural resource management
- Agricultural systems modeller developing decision-support tools and scenario analyses for government, industry, or agritech companies
- Environmental or sustainability consultant conducting assessments of agricultural impacts, climate risks, resource-use efficiency, or sustainable production pathways
- Data scientist or geospatial analyst working with agricultural, environmental, or Earth observation datasets
- Specialist in digital agriculture supporting the development of farm management tools, precision agriculture applications, or agricultural intelligence platforms

3 How to apply

The application process consists of two steps:

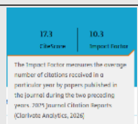
- **Step 1**: Apply to the principal PhD advisor for endorsement of your PhD proposal.
- **Step 2**: Apply to the UniSQ Graduate School for a scholarship and tuition fee waiver.

It is important to note that agreeing with a principal PhD advisor on a PhD proposal (step 1) does not guarantee the receipt of a scholarship or tuition fee waiver (step 2).

3.1 PhD proposal endorsement

To receive endorsement by the principal PhD advisor, please first submit the following documentation to the principal PhD advisor (email: uwe.grewer@unisq.edu.au):

- Curriculum vitae
- A PhD proposal *(following the format provided in the appendix)*
- The academic transcript from your highest obtained educational degree *(identifying the names of individual courses/subjects and the obtained grades)*
- The thesis/dissertation submitted as part of your highest completed degree *(e.g., Bachelor's honours thesis or Master's thesis)*
- Reference letters of any relevant previous employment.
- A list of your scientific publications (if any) following the format below:

	Publication title	**Authors list** (own name in bold)	**Journal name/book title**	**DOI / ISBN**	**Clarivate Journal Impact Factor** (Note: Typically published on Journal website)	**Scopus: Highest Percentile (Discipline)** (https://www.scopus.com/sources)	**Web of Science Collection** (https://mjl.clarivate.com/home)
Example:	Crop models as decision support tools in digital agriculture: The APSIM-based RotationARM tool in Australia	**Uwe Grewer**, Andrew Zull, Roy Anderson, Keith G. Pembleton	Computers and Electronics in Agriculture	https://doi.org/10.1016/j.compag.2026.111725	10.3	99 (Agronomy and Crop Science)	Science Citation Index Expanded
Illustrating screenshots from source:							

A thorough conceptualisation of your PhD ideas at this stage is highly valuable. Careful preparation of your proposal and constructive discussions with your prospective PhD advisor help ensure alignment between your expectations, research aspirations, skills, and the realities of undertaking a PhD. This process represents an important first step towards a successful PhD journey by establishing a strong foundation for your future research.

Note on the use of Artificial Intelligence: Artificial Intelligence (AI) tools can have an appropriate role in some areas of research. However, by experience, the reliance on AI tools to develop your initial PhD proposal is often highly counterproductive.

A strong proposal should reflect your own current understanding of the research topic, your existing knowledge, and your ability to think critically about research questions and methodologies. Using AI tools to introduce concepts, methods, or ideas that you do not yet genuinely understand may result in a proposal that appears stronger on paper but cannot be meaningfully articulated in subsequent conversations with your prospective PhD advisor. This will undermine your credibility even in areas where you can rightfully claim a high level of expertise and knowledge.

It is important to recognise that we do not expect from incoming PhD students to have all the knowledge, skills, or research experience required at the beginning of their candidature. Developing these capabilities is a central part of the PhD journey. Part of the initial discussions with your prospective PhD advisor is to identify areas where you may require further skill development and assess whether this can realistically be achieved within the timeframe of a PhD candidature. This assessment also considers whether the required skills align with the chosen research topic and whether they can be adequately supported by the expertise and specialisation areas of the supervisory team. The use of AI tools can easily obscure this process of identifying in which areas you already have substantial expertise and which areas are a priority for skill development during the PhD. This is why the use of AI tools in preparing your PhD proposal may risk setting you up for failure rather than helping you become more competitive. Therefore, please prepare your PhD proposal independently and use it as an authentic starting point for identifying your strengths, learning needs, and future research direction.

3.2 Scholarship application

The latest information on scholarships with UniSQ can be accessed at: https://www.unisq.edu.au/scholarships. Depending on your residency status (Australian residency status vs international student), different types of scholarships will be relevant to you.

Most prospective applicants are interested in a scholarship that provides a full stipend for a maximum of three years (currently AUD $38,000 per annum; subject to change). For international students, it is further of interest to obtain a scholarship covering tuition fees (domestic students are automatically exempt). Typically, these scholarship rounds have a deadline in September each year (subject to change; see indicated website for most recent information) and require several months to prepare.

For applicants interested in a joint PhD programme with an international partner, as well as for students applying for the UniSQ collaboration with the China Scholarship Council, other deadlines apply.

The specific application documents vary by scholarship, but typically include:

- Curriculum vitae
- Research thesis topic proposal
- Statement of Claim
- Supervisor support letter
- Industry partner support letter (if applicable)

Specific information has to be obtained from the respective scholarship website. Generally, the material used to obtain the PhD proposal endorsement from your future principal PhD advisor will be a good basis to prepare all the above documentation.

Scholarship application rounds at UniSQ are highly competitive. Only thoroughly prepared applications have a realistic chance of being selected. Core *selection criteria* include:

- Past academic achievements of the applicant
- Demonstrable skills and capabilities of the applicant
- Quality of the proposed research project
- Suitability of the PhD advisory team

3.3 Eligibility criteria

Applicants must meet the academic entry requirements for a PhD program in Australia. This generally means holding a recognised qualification equivalent to an Australian Bachelor Honours degree with First Class Honours, a Master's degree with a substantial research component, or another qualification demonstrating equivalent research preparation. Applicants with qualifications obtained outside Australia should check how their previous studies are assessed against Australian standards and whether they meet the relevant PhD admission requirements. Further information can be found through the university's PhD admission guidelines and qualification assessment resources, including the Australian Government's qualification recognition information: https://www.education.gov.au/qualifications-recognition.

Note for international applicants: If you require a visa to reside in Australia during your PhD, you will need to meet the requirements specified by the Australian Department of Home Affairs: https://immi.homeaffairs.gov.au/visas/getting-a-visa/visa-listing/student-500.

You can only apply for a visa after receiving a Confirmation of Enrolment (CoE) from your future university. However, it is recommended that you familiarise yourself with the visa requirements and eligibility criteria early in the process using the Department of Home Affairs' guidance and assessment tool: https://immi.homeaffairs.gov.au/visas/web-evidentiary-tool. This will give you sufficient time to prepare documents and certifications that may take time to obtain, including evidence issued by government agencies, educational institutions, or other organisations. Preparing these requirements early can help reduce administrative pressure closer to your intended PhD commencement date. Particularly, many international candidates complete their English language certification requirements very early in the process to avoid delays and reduce the number of tasks to be completed closer to the start of their degree.

4 Principal PhD advisor

The PhD opportunities advertised here will be supervised by Dr Uwe Grewer, a Research Fellow in the Agricultural Systems Modelling Group within the Centre for Sustainable Agricultural Systems.

Uwe is a researcher in agricultural development economics and biophysical modelling of farming systems. His core research interests focus on the interlinkages between environmental sustainability and socio-economic outcomes of farming systems, both in Australia and in low-income countries. His research is focussed on system-level interactions of agricultural systems. As main methodologies, he is utilising cropping system models (APSIM), econometrics, and data science while leveraging high-resolution spatio-temporal data.

Photo: Dr. Uwe Grewer – Research Fellow in the Agricultural Systems Modelling Group

Uwe is currently serving as the chair of the Reference Panel of the APSIM Initiative, which provides scientific oversight for the ongoing development of APSIM, one of the world's most widely used crop simulation models.

He has developed multiple decision-support tools for governments and industry, such as the Agricultural Risk Management of Crop Rotations tool (RotationARM: www.armonline.com.au/ra), and centrally contributed to the EX-Ante Carbon balance Tool (FAO EXACT: https://exact.apps.fao.org/)

Within the Agricultural Systems Modelling Group, Uwe is involved in leading and delivering a diverse range of research projects, most recently focusing on drought resilience and sustainable soil management.

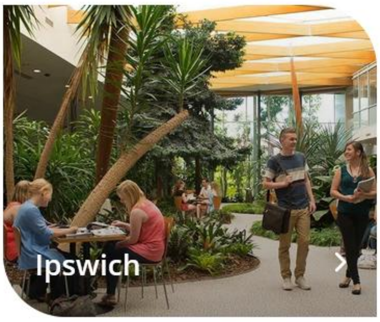
Prior to joining UniSQ, he worked for six years on climate-smart agriculture for the Food and Agriculture Organisation of the United Nations (FAO).

The advisory team will be complemented by secondary and tertiary advisors that will vary based on the study topic.

5 About the University of Southern Queensland

The University of Southern Queensland (UniSQ) is a public Australian university with a strong commitment to research, innovation, and regional impact. Established in 1967 as the Queensland Institute of Technology (Darling Downs), it has grown into a comprehensive university with a national and international outlook.

UniSQ's main campus is located in **Toowoomba**, a vibrant regional city in Queensland, approximately 90 minutes west of Brisbane. Toowoomba is an authentic regional community with much character, located on the crest of the Great Dividing Range. As a well-established regional centre, it offers a comprehensive range of services, including excellent healthcare, modern infrastructure, diverse dining and cultural opportunities, and all the amenities expected of a major city, but without the congestion and high living costs of larger metropolitan areas. Residents benefit from a more relaxed pace of life, stronger community connections, and more affordable housing, while remaining within easy reach of Brisbane and other coastal destinations. UniSQ has further campuses in **Springfield** and **Ipswich**, both located within the rapidly growing Greater Brisbane region. This network of campuses reflects UniSQ's commitment to serving diverse communities by providing accessible, flexible, and high-quality education and research opportunities across a range of locations and contexts. With a proud history as an early innovator in distance education, UniSQ has evolved from a pioneer of flexible learning into a contemporary leader in high-quality online and blended education, extending opportunities to students across diverse locations and life circumstances.



UniSQ campus locations

A key feature of UniSQ is its combination of **high-quality facilities with a personalised learning and research environment**. UniSQ provides extensive research and teaching infrastructure, including specialist laboratories, research facilities, a modern library, residential colleges, and unique experimental field trials. Unlike larger metropolitan universities where students may experience a more impersonal environment, UniSQ offers close interaction between researchers, supervisors, and students, creating a supportive setting for doctoral research.

UniSQ's distinctiveness lies in its strong connection between research and real-world impact. As a regional university with global ambitions, UniSQ works closely with industry, government, and communities to address practical challenges across areas such as agriculture, engineering, health, education, business, and the environment. This combination of research excellence, accessibility, and community engagement provides PhD candidates with an environment where their research can develop meaningful academic and societal impact.

UniSQ campus impressions

6 Appendix: PhD proposal template

Thank you for your interest in undertaking a PhD within our research group. This document is intended to help you outline your proposed research ideas, methodological approach, and technical background in a structured and concise manner. The purpose of this submission is to present a first, indicative research proposal. This includes demonstrating how you think about research problems, how you would approach them methodologically, and how you envisage the progression of a PhD project.

Your PhD proposal is instrumental to establish a clear understanding of the intended research focus, analytical methods, and technical requirements. Please follow the guidance provided under each heading below and keep the overall length roughly within the specified limits. Please provide the document in an editable format (i.e., Microsoft Word). Please include DOIs for references (whenever available).

6.1 Research topic and problem statement

(Indicative length: ~1-2 pages)

Describe the overall research topic. Explain how the proposed research addresses a problem of societal relevance, supported by appropriate evidence. Clearly articulate the prevailing knowledge gaps in current scientific approaches and the existing literature. Describe both the practical problem motivating the research and the underlying scientific problem that prevents current approaches from adequately addressing it. Explain how addressing the identified research gaps would meaningfully contribute to addressing the stated problem.

6.2 Proposed research

(Indicative length: ~2-3 pages)

Provide an overview statement of your overall research objectives and aims.

Outline three core research questions, each corresponding to a planned research publication (which will correspond to your core PhD thesis chapters). The questions should:

- Be clearly linked to the overall research topic
- Represent distinct but related sub-issues
- Show logical and/or methodological progression across the PhD

Clearly articulate the expected scientific contribution or central proposition being tested or addressed by each research question. This should clarify the value proposition of the proposed research by explaining how each research question advances current knowledge, addresses identified gaps, or provides new insights, methods, or applications.

Note: Do not propose a literature review as one of the research publications. A literature review will be conducted as part of every PhD at UniSQ.

For each research question:

- Provide a brief overview of current major research on the issue
- Articulate the prevailing knowledge gaps
- Identify the value generated by your research

6.3 Research methodology

(Indicative length: ~4-8 pages)

Provide a technical description of the research methods to address each of the three research questions. This section should demonstrate depth of methodological understanding and should go beyond naming generic approaches. Specifically:

- Describe the analytical or modelling frameworks you plan to use and how they will be applied
- Clarify your methodological focus of interest (e.g. causal inference, model development, model evaluation, uncertainty analysis, data integration, etc.)
- Where possible and adequate: Include core equations of your proposed analysis
- Specify anticipated data sources (simulations, field data, survey data, remote sensing data etc.)
- Where relevant, comment on assumptions, limitations, or challenges

Note: Simply listing methods such as “regression analysis”, “crop modelling”, or “machine learning” without further specification is insufficient. The three research chapters may have shared methodological approaches but should not be entirely identical.

6.4 Technical background & skills of the candidate

(Indicative length: ~1-3 pages, tables are encouraged)

Provide a brief summary of your past research experience (e.g., as part of the preparation of previous theses or larger research projects).

Summarise your technical background relevant to this PhD. Be specific and provide evidence of past experience when possible. Please address specifically all of the following areas, if applicable to your research field:

- Programming and data analysis tools (e.g. R, Python, etc.): indicate your level of proficiency and provide concrete examples of use (e.g. coursework, thesis work, research projects).
- Statistical and data science methods: describe your experience with relevant statistical techniques, modelling approaches, or data science workflows, including examples of how they have been applied in practice.

- Process-based crop and environmental modelling: describe any experience using process-based crop models (e.g., APSIM, DSSAT) or other process-based environmental/biophysical models. Include the context in which the models were applied, your specific role (e.g., model setup, parameterisation, calibration, scenario simulation, or evaluation), and any insights gained from applying these models to real-world research questions.
- GIS and spatial data analysis: describe any experience managing, analysing, or visualising spatial data, including software, data types, and typical workflows.
- Scientific reproducibility and research workflows: indicate your familiarity with tools and practices such as version control (e.g. Git/GitHub), containerisation (e.g. Docker), and your past experience in generating well-documented and reproducible research.
- Literature management and referencing software: describe your experience with tools such as EndNote, Zotero, or similar, including how they have been used in previous research outputs.

Where possible, support your claims with concrete examples from prior study or research (e.g. MSc thesis, technical reports, publications, or code repositories). Self-assessments should be realistic and clearly evidenced.