

UNIVERSITY OF TECHNOLOGY SYDNEY (UTS)

DOCTORAL THESIS

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**Participatory Modelling of Socio-Ecological  
Systems: *Lessons from a human-centered case  
study on regenerative agriculture***

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*in the*

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## Declaration of Authorship

I, Daniel C. KENNY, declare that this thesis titled, “Participatory Modelling of Socio-Ecological Systems: *Lessons from a human-centered case study on regenerative agriculture*” declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Engineering and Information Technology at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by the Australian Government Research Training Program.

Signed:

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Date:

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*“Plans to protect air and water, wilderness and wildlife are in fact plans to protect man.”*

Stewart Udall, US Secretary of the Interior 1961-1969

*“You cannot protect the environment unless you empower people, you inform them, and you help them understand that these resources are their own, that they must protect them.”*

Dr. Wangari Maathai, Winner of the 2004 Nobel Peace Prize

*“The greatest of all determining factors on the health regeneration or else degradation of those very landscapes boils down to the way we think, what we believe, and how we model in our minds the way the world and our landscapes work.”*

Dr. Charles Massy, *The Call of the Reed Warbler*



UNIVERSITY OF TECHNOLOGY SYDNEY (UTS)

## *Abstract*

Faculty of Engineering and Information Technology (FEIT)

School of Information, Systems, and Modelling (ISM)

Doctor of Philosophy

**Participatory Modelling of Socio-Ecological Systems: *Lessons from a human-centered case study on regenerative agriculture***

by Daniel C. KENNY

The ability to tackle ‘wicked’ problems that involve complex interactions between economic, social, and environmental systems is a key challenge of the modern era. Addressing the root of the problems of these socio-ecological systems (SES) requires a more nuanced understanding of how human behavior can help or hinder the collaboration necessary to achieve transformation of the system. Participatory Modelling (PM) — the co-production of knowledge with stakeholders via facilitated modelling workshops — plays a critical role in this endeavour, for its ability to elicit and shape mental models and reveal tacit knowledge which could otherwise be concealed in ‘black-box’ scientific modelling practices. The difficulties of working with stakeholders and ensuring systemic change are well noted in the PM literature, but the field has yet to fully embrace, in a systematic and deliberate fashion, insights from other fields about how best to work with people at the center of the process. Fortunately, disciplines like neuroscience, psychology, sociology, education, and others have uncovered insights about the way the human mind works and how best to accommodate its behavioral nuances and tendencies. In this thesis, I seek to elucidate where and how the behavioral sciences—how people think, learn, and behave— might improve the design, facilitation, and evaluation of PM to drive better management of SES. In a PM case study, I examine the adoption of regenerative agriculture in Australia as an example of one such system.

This thesis investigates the potential to actualize transdisciplinary insights from behavioral sciences to improve PM. In this thesis, I will:

- Explore how simulation models and PM can address the challenges that people present to the PM process and to improving management of SES (Chapter 2, *published* and Chapter 3, *in review*);

- Deepen our understanding of what PM seeks to accomplish, what a transdisciplinary approach has to offer in accomplishing those aims, and how a systems based perspective (Systems Intelligence) can help in avoiding piecemeal approaches (Chapter 4, *submitted*);
- Through a case study focusing on regenerative agriculture, offer a lens into an actual PM process and what can be discovered about a particular SES through such a workshop (Chapter 5);
- Evaluate the process of my PM workshop, leading to the development of a 'toolkit' of soft approaches for PM: principles, strategies and tactics to assist PM facilitators in the design, facilitation, and evaluation of PM (Chapter 6); and finally,
- Review the practical, methodological, and theoretical implications of these findings for the improvement of PM, the management of SES, and future research.

The findings of this research suggest that explicitly translating and operationalizing transdisciplinary insights from behavioral sciences into PM practice can advance the process we use to build a model with stakeholders. Ultimately, this thesis provides an approach and practical insights that can be adopted by PM practitioners, but also more broadly for researchers and policymakers seeking to take a behaviorally-attuned stance to moving towards the resilience, sustainability, and prosperity our society so desperately needs.



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# List of Abbreviations

<b>PM</b>	<b>Participatory Modelling</b>
<b>SES</b>	<b>Socio-Ecological Systems</b>
<b>FCM</b>	<b>Fuzzy Cognitive Mapping</b>
<b>RegenAg</b>	<b>Regenerative Agriculture</b>





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