

Adaptive Co-management of Small Tank Cascade Systems in Sri Lanka in a Changing Climate

By
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Doctor of Philosophy
under the supervision of
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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, *Bhathiya Kekulandala*, declare that this thesis, is submitted in fulfilment of the requirements for the award of *Doctor of Philosophy*, in the *Institute of Sustainable Futures* at the University of Technology Sydney.

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List Of Abbreviations

ACM - Adaptive Co-management
CA - Comprehensive Assessment of Water Management in Agriculture
DAD - Department of Agrarian Development
ENSO - El Niño, Southern Oscillation
FAO - Food and Agricultural Organization of the United Nations
GCF - Green Climate Fund
GIAHS - Globally Important Agricultural Heritage System
GIS - Geographical Information Systems
IOD - Indian Ocean Dipole
ID - Irrigation Department
IPCC - Intergovernmental Panel on Climate Change
IUCN - International Union for Conservation of Nature and Natural Resources
IWMI - International Water Management Institute
MJO - Madden Julian Oscillation
NAPS - National Adaptation Plan for Climate Change
NGO's - Non Governmental Organizations
QBO - Quasi-Biennial Oscillation
RCM - Regional Climate Models
SNA - Social Network Analysis
SRES - Special Report on Emission Scenarios
SSI - Semi-structured Interviews
STCS - Small Tank Cascade Systems
UN - United Nations
UNDP - United Nations Development Programme
UNFCCC - United Nations Framework Convention on Climate Change

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Abstract

Sri Lanka produces nearly 80% of its food requirement, and most produced in the country's dry zone. The seasonality of rainfall and undulating geomorphology of the dry zone led to the development of small tanks to store water, and over time these evolved into complex, multi-purpose small tank cascade systems (STCS). A community-led process governed STCS, but the British colonial administration abandoned community-led management favouring centralised bureaucracy. Centralisation continued in the post-colonial period leading to the degradation and deterioration of STCS. Recent research indicates that STCS can improve rural communities' food and livelihood securities and buffer the risks of climate change. The Sri Lankan Government and the United Nations Development Program (UNDP) are implementing a Green Climate Fund¹ project in Sri Lanka to rehabilitate STCS and introduce cascade-based adaptive governance systems.

This thesis investigates the potential to incorporate adaptive governance for managing STCS in a globally recognised agricultural heritage system (Palugaswewa STCS) in Northcentral Sri Lanka and its implications for ongoing climate adaptation. I used a diagnostic framework for adaptive co-management (ACM) (Plummer et al., 2017) to look for evidence of ACM that could support STCS adaptive governance and climate adaptation using a three-step methodology: 1. document and policy analysis to assess the evolution of STCS governance, 2. social network analysis (SNA) to identify key actors, and governance structures, and 3. semi-structured interviews to reveal governance processes, roles of key actors, and enablers and barriers of changes in governance. At each stage, implications for adaptive governance and climate change adaptation were considered.

My findings showed the governance of STCS as primarily community-led, flexible and robust, but centralised, formal institutional mechanisms led to governance inadequacies. A previously undocumented, informal decision process (pre-cultivation meeting) employed farmer experience of past weather/climate patterns to drive the formal decision process (cultivation meeting) and compensates for lack of timely meteorological information, allows stakeholder collaboration and knowledge co-development, and facilitates ACM. However, SNA-derived structures and measures showed significant vulnerabilities in STCS knowledge sharing around existing close social and family relationships, community norms, and values that need to be considered in efforts to enhance STCS governance.

¹ <https://www.greenclimate.fund/project/fp124>

I conclude that strengthening adaptive governance for climate change adaptation needs further research in a broader range of STCS, provision of user-centred meteorological information, recognition of existing informal governance processes and information flows among actors, and recasting legal frameworks at local and national scales to enable diversification of agricultural practices.