Ecologically Engineered Primary Production in Central Queensland, Australia - Integrated Fish and Crayfish Culture, Constructed Wetlands, Floral Hydroponics, and Industrial Wastewater

Dissertation for the Qualification of Doctor of Philosophy - Applied Science

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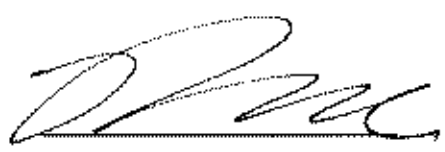
DECLARATION

I hereby declare that the main text in this manuscript is an original work of mine, except where acknowledged, and no part of it has been previously submitted for the award of any other degree.

I also declare that, to the best of my knowledge, any assistance I received in the experimentation presented, and all sources of information cited in this manuscript have been acknowledged.



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Prologue

The issue of sustainability has greatest significance in the midst of unilateral bio-socioeconomic degradation resulting from intense and increasing societal pressures placed on the unified global ecology. In such an environment, sustainable development seeks to manage natural resources within a free market economy, aiming to meet the needs of today's population, and to protect and enhance current resource quality and abundance. In this light, techniques of integrated sustainable primary production and wastewater management are the subject matters of this applied research.

There are many researchable issues which could be addressed within the subject matter. The first focus in the research scope was driven by the most severe sustainability issue facing Central Queensland (Australia) in 2000: the depletion and degradation of freshwater supplies. Central Queensland (CQ) is an arid sub-tropical region that has suffered from a marked reduction in rainfall and increase in temperature over the last 100 years, {Miles, 2004 #172}, and by the year 2000, conditions had been exacerbated by eight years of severe drought and warmer than average temperatures and resulted in widespread animal and crop failures due to freshwater shortages.

Such a problem required a multi-faceted ecological, social, and economic approach. Hence, research centred on investigating the science of integrating regional water-related industries and agribusiness, and biodiverse ecosystems to achieve water and wastewater reuse applications, and associated eco-socioeconomic benefits.

Specifically, this research investigates the integration of (a) electrical power station wastewater (b) barramundi culture, (c) red claw culture, (d) constructed wetlands (for water quality management and habitat creation), and (e) hydroponic flower culture.

This research produced outcomes of integrated water and wastewater reuse and recycling, marketable agriproducts production (fish, crayfish, and flowers), water and wastewater reuse and conservation, wetland primary production, carbon dioxide sequestration, aquatic pollution control, and biodiversity creation and support.

Successful design and management, experimental trialing and evaluation of system components and subjects, and the development of a knowledge base including static and dynamic system models, represent advances in respective research areas, and underpin the emerging discipline of integrated systems approaches to eco-socioeconomic development. Additionally, several gaps in the current body of knowledge regarding integrated systems were filled, and interactive management tools were developed. Apart from this study, the integration of technologies (as described above) has not, to this author's knowledge, been accomplished.

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