Facilitating Sustainable Catchment Management Through Spatial Data Infrastructure Design and Development

Dev Raj Paudyal
PhD Candidate
University of Southern Queensland, Australia

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Outline of Presentation

- Background
- Research Problem, Hypothesis and Aim
- Research Objectives
- Significance and Outcomes
- Research Design
- Study Area and Data Analysis
- Progress

Background

Catchment management issues are characterised by multiple stakeholders and multiple goals.

- Institutional complexities for catchment management
- Spatial data can assist for many catchment decisions

Photo Source: A/Prof. Kevin McDougall and Internet
Background (Spatial Data and Decision Making)

<table>
<thead>
<tr>
<th>Key Issues</th>
<th>Application of Spatial Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biodiversity, Less Native Plant</td>
<td>Biodiversity Mapping, Spatial Decision Making</td>
</tr>
<tr>
<td>Community Capacity Building</td>
<td>Community Awareness, Education</td>
</tr>
<tr>
<td>Climate Change</td>
<td>Assessment of Vulnerability and Adaptation</td>
</tr>
<tr>
<td>Floodplains, Land Erosion, Land Degradation</td>
<td>Flood Modelling, Erosion Zoning, Emergency Management, Future Forecasting</td>
</tr>
<tr>
<td>Land Use Planning and Soil Conservation</td>
<td>Land Use Mapping, Soil Mapping</td>
</tr>
<tr>
<td>Pest Animal and Weed Management</td>
<td>Weed Mapping, Habitat Mapping</td>
</tr>
<tr>
<td>Water Resource Management (including water quality and availability)</td>
<td>Mapping and Modelling of Water Resources, EIA</td>
</tr>
</tbody>
</table>

(Paudyal et al., 2008)

Background (Complex Jurisdictional Environment)

<table>
<thead>
<tr>
<th>Spatial Data</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topographical Base</td>
<td>Local</td>
</tr>
<tr>
<td>DEM</td>
<td>X</td>
</tr>
<tr>
<td>Cadastre</td>
<td>X</td>
</tr>
<tr>
<td>Soil and Geology</td>
<td>X</td>
</tr>
<tr>
<td>Watershed/Catchment</td>
<td>X</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>X</td>
</tr>
<tr>
<td>Land Use/Land Cover</td>
<td>X</td>
</tr>
<tr>
<td>Metrology</td>
<td>X</td>
</tr>
<tr>
<td>Climate</td>
<td>X</td>
</tr>
</tbody>
</table>

(Paudyal et al., 2009)

Research Problem, Hypothesis and Aim

Research Problem
"Three Levels of Governments"
"Varying Scale and Data"
"Different Custodians"
"Multiple Stakeholders"

Research Hypothesis
"An appropriately designed SDI model will improve the spatial data sharing and partnerships between different levels of administrative/political jurisdictions and catchment hierarchies and hence promote sustainable catchment management".

Research Aim
"To develop a SDI Hierarchy Model for Sustainable Catchment Management"

Adapted from (Rajabifard et al., 2003)
**Research Objectives**

- To review the SDI theoretical foundation
- develop conceptual framework
- To identify key issues that facilitate/constraint SDI development at catchment scale
- To develop a SDI model/framework
- To evaluate the SDI model/framework

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**Research Design**

- Research Formulation
- Develop Conceptual Framework
  - Case Studies
  - Field Work
  - Model Development and Evaluation
  - Model Revision and Formalisation
  - Conclusions and Future Research

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**Theoretical Background for SDI Development**

- Evolution Theory and SDI Evolution
- Theoretical Background for SDI Development
  - Diffusion Theory and SDI Diffusion
  - Hierarchical Spatial Theory and SDI Hierarchy
- P-A: Theory and Partnerships and Collaboration
Conceptual Frameworks Formulation

CF1: Applying Hierarchical Spatial Theory
CF2: Applying P-A Theory

Case Study Area

Data Source: MDBA and CCMA

MDB and Condamine Catchment (Queensland), Australia

Case Study Description

- MDB is Australia’s largest drainage divisions and covers one-seventh of the continent
- It is ranked fifteenth in the world in terms of length and twenty first in terms of area
- It falls under the four state jurisdictions and one territory
- Catchment communities and governments are the main stakeholders
- Total 22 catchment management authorities and 67,000 farmers
Case Study Description

Management hierarchies in catchment governance in the MDB

Case Study Analysis

- Cross-jurisdictional Boundaries

Data Source: MDBA

<table>
<thead>
<tr>
<th>STATE (Region)</th>
<th>CMA (Number)</th>
<th>LOCAL GOVERNMENT AUTHORITIES (LGAs)</th>
<th>Number of LGAs that fall within catchment boundary</th>
<th>Number of LGAs that straddle catchment boundary (number)</th>
<th>Total</th>
<th>Proportion of LGAs that straddle catchment boundary in each state</th>
</tr>
</thead>
<tbody>
<tr>
<td>QLD</td>
<td>4</td>
<td>9</td>
<td>29</td>
<td>38</td>
<td>76%</td>
<td>76%</td>
</tr>
<tr>
<td>NSW</td>
<td>9</td>
<td>30</td>
<td>48</td>
<td>78</td>
<td>52%</td>
<td>52%</td>
</tr>
<tr>
<td>VIC</td>
<td>5</td>
<td>10</td>
<td>24</td>
<td>38</td>
<td>71%</td>
<td>71%</td>
</tr>
<tr>
<td>SA</td>
<td>3</td>
<td>4</td>
<td>15</td>
<td>13</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>ACT</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>22</td>
<td>54</td>
<td>116</td>
<td>178</td>
<td>79%</td>
<td>79%</td>
</tr>
</tbody>
</table>

(Paudyal et al., 2009)
Model Development and Testing

- **Model Development**
  - Triangulation of existing theory, field data and case study results
- **Model Testing**
  - Local experts and stakeholders
  - Software Testing (Object-Oriented Technology)
  - Another Jurisdiction and research community

Progress and Issues

- **Progress**
  - Literature Review
  - Conceptual Framework Development and Testing
  - Case Study Areas Selection
  - Collection of Catchment Data from MDB and Condamine Catchment
- **Issues**
  - Selection of Appropriate Case Study Areas
  - Number and Catchment Hierarchy
  - National or International (for testing)
  - Theoretical Foundation
    - Only Four or More
  - Data Analysis Methodology

Thanks for your attendance

**Discussions!**