

2007

Evaluating the use of GIS by public participants in environmental decision-making processes: a case study approach

Emma McIntyre
University of Wollongong

Follow this and additional works at: <https://ro.uow.edu.au/theses>

University of Wollongong

Copyright Warning

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site.

You are reminded of the following: This work is copyright. Apart from any use permitted under the Copyright Act 1968, no part of this work may be reproduced by any process, nor may any other exclusive right be exercised, without the permission of the author. Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material.

Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

Unless otherwise indicated, the views expressed in this thesis are those of the author and do not necessarily represent the views of the University of Wollongong.

Recommended Citation

McIntyre, Emma, Evaluating the use of GIS by public participants in environmental decision-making processes: a case study approach, PhD thesis, School of Earth & Environmental Sciences, University of Wollongong, 2007. <http://ro.uow.edu.au/theses/721>

NOTE

This online version of the thesis may have different page formatting and pagination from the paper copy held in the University of Wollongong Library.

UNIVERSITY OF WOLLONGONG

COPYRIGHT WARNING

You may print or download ONE copy of this document for the purpose of your own research or study. The University does not authorise you to copy, communicate or otherwise make available electronically to any other person any copyright material contained on this site. You are reminded of the following:

Copyright owners are entitled to take legal action against persons who infringe their copyright. A reproduction of material that is protected by copyright may be a copyright infringement. A court may impose penalties and award damages in relation to offences and infringements relating to copyright material. Higher penalties may apply, and higher damages may be awarded, for offences and infringements involving the conversion of material into digital or electronic form.

EVALUATING THE USE OF GIS BY PUBLIC PARTICIPANTS IN
ENVIRONMENTAL DECISION-MAKING PROCESSES:
A CASE STUDY APPROACH

A thesis submitted in fulfillment of the
requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

EMMA MCINTYRE
BACHELOR OF ENVIRONMENTAL SCIENCE (HONOURS)

SCHOOL OF EARTH AND ENVIRONMENTAL SCIENCE

2007

Certification

I, Emma M. McIntyre, declare that this thesis, submitted in fulfillment of the requirements for the award of Doctor of Philosophy, in the School of Earth and Environmental Science, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Emma M. McIntyre

Table of Contents

Table of Contents	iii
List of Figures.....	ix
List of Tables	xi
List of Photos	xi
Abstract.....	xii
Acknowledgements.....	xiv
Chapter 1: Introduction	1
1.1 Project Background.....	1
1.2 Problem Statement	1
1.3 The Research Question	2
1.4 Study Objectives	2
1.4.1 The “top-down” approach.....	3
1.4.2 The “bottom-up” approach.....	3
1.4.3 Summary	4
1.5 Thesis Structure.....	4
Chapter 2: Public Participation in Environmental Decision-making and a role for GIS	5
2.1 Public Participation in Environmental Decision-making.....	5
2.2 The role of GIS in environmental decision-making.....	14
2.3 GIS and Society	16
2.4 PPGIS Methods and Models	18
2.5 Potential benefits of PPGIS.....	21
2.6 Challenges for PPGIS	24
2.6.1 Evaluation Methods	24
2.6.2 Access to resources	25
2.6.3 WebGIS.....	26
Chapter 3: Contextual information for the research methodology.....	29
3.1 Theoretical perspectives of the research methodology	29
3.1.1 Qualitative research.....	29
3.1.2 The use of case studies.....	31

3.2 Environmental management in Australia: an overview	32
3.3 Case Study 1: Kiama Local Environment Plan Review	37
3.3.1 Background	37
3.3.2 Setting the Scene	37
3.3.3 The Local Environment Plan Review Process	41
3.3.4 Designing community consultation for the Kiama LEP Review- acknowledging the limitations	42
3.3.5 The Community Panel	42
3.3.6 Summary	45
3.4 Case Study 2: Landcare Illawarra Community GIS	45
3.4.1 Background	45
3.4.2 Setting the Scene	47
3.4.3 Summary	49
Chapter 4: Methodology of GIS intervention	51
4.1 Case Study 1: Kiama Local Environmental Plan Review	51
4.1.1 Jamberoo: A mini case study	51
4.1.2 Preparing GIS data for use in the Kiama Community Panel	59
4.1.3 The Presentations	63
4.1.4 The Deliberations	69
4.1.5 The Kiama LEP WebGIS	69
4.1.6 Data Collection	77
4.1.7 Data Analysis	79
4.1.8 Limitations	80
4.1.9 Ethical considerations	83
4.2 Case Study 2: Landcare Illawarra Community GIS Project	84
4.2.1 Participant recruitment	84
4.2.2 Mapping exercises	84
4.2.3 GPS Training	85
4.2.4 GIS Training	87
4.2.5 Developing the Landcare Illawarra Community GIS	88
4.2.6 Landcare Illawarra WebGIS	91

4.2.7 Data Collection	95
4.2.8 Data Analysis	96
4.2.9 Limitations	97
4.2.10 Ethical considerations	99
Chapter 5: Evaluation Framework	101
5.1 Previous Evaluation Studies.....	101
5.2 Evaluation criteria for determining the usefulness of GIS to participants in the Kiama Community Panel and Landcare Illawarra Community GIS Project.....	105
5.3 Limitations of applying the Evaluation Criteria.....	105
Evaluation Criterion 1: Was the GIS information provided easy to use and/or interpret?	105
Evaluation Criterion 2: Did the GIS assist the participant in their role, or help them in any way?	106
Evaluation Criterion 3: Did the GIS have an impact on decisions being made or the opinions of participants?	106
Evaluation Criterion 4: Were participants comfortable with using the GIS?	106
Evaluation Criterion 5: Did the GIS meet the expectations of the participants?	107
Evaluation Criterion 6: What were the most useful functions of the GIS?.....	107
Evaluation Criteria 7: Will participants be able to use GIS in future?.....	107
Chapter 6: Results from the Kiama Local Environment Plan Review	109
6.1 The Participants.....	109
6.1.1 Gender	110
6.1.2 Age	110
6.1.3 Indigenous background	111
6.1.4 Born in Australia.....	111
6.1.5 Language spoken at home	111
6.1.6 Level of education.....	111
6.1.7 Occupation	111
6.1.8 Home ownership	112
6.1.9 Length of time in Kiama municipality	112
6.1.10 Information source	112

6.1.11 Closest town.....	112
6.1.12 Rural - residential distribution	114
6.1.13 Computer access	114
6.1.14 Internet access	114
6.1.15 Map reading ability	114
6.2 Evaluation of the Community Panel process	115
6.2.1 Issues of concern in planning for Kiama's future	115
6.2.2 Main purpose for participating in the Community Panel.....	116
6.2.3 Satisfaction with the Community Panel process.....	116
6.3 Applying the Evaluation Criteria	116
Evaluation Criterion 1: Was the GIS information provided easy to use and/or interpret?	116
Evaluation Criterion 2: Did the GIS assist the participant in their role, or help them in any way?	120
Evaluation Criterion 3: Did the GIS have an impact on decisions being made/opinions?	123
Evaluation Criterion 4: Were participants comfortable with using the GIS?	127
Evaluation Criterion 5: Did the GIS meet the expectations of the participants?	128
Evaluation Criterion 6: What were the most useful functions of the GIS?.....	128
Evaluation Criterion 7: Will participants be able to use GIS in future?	132
6.4 Kiama WebGIS	133
Chapter 7: Results from Landcare Illawarra Community GIS	135
7.1 The Participants.....	135
7.1.1 Gender	136
7.1.2 Age	136
7.1.3 Indigenous background	136
7.1.4 Born in Australia.....	136
7.1.5 Language spoken at home.....	136
7.1.6 Level of education.....	136
7.1.7 Occupation	137
7.1.8 Home ownership	137

7.1.9 Municipality	137
7.1.10 Time in Illawarra.....	137
7.1.11 Rural – residential distribution.....	137
7.1.12 Computer Access	137
7.1.13 Internet Access	138
7.1.14 Previous GIS Experience	138
7.2 Evaluation of the Landcare Illawarra Community GIS Project.....	138
7.2.1 Information Source.....	139
7.2.2 Environmental issues	139
7.2.3 Landcare Projects.....	140
7.2.4 Satisfaction with participation.....	140
7.3 Applying the Evaluation Criteria	141
Evaluation Criterion 1: Was the GIS information provided easy to use and/or interpret?	141
Evaluation Criterion 2: Did the GIS assist the participant in their role, or help them in any way?	153
Evaluation Criterion 3: Did the GIS have an impact on decisions being made or the opinions of participants?	156
Evaluation Criterion 4: Were participants comfortable with using the GIS?	156
Evaluation Criterion 5: Did the GIS meet the expectations of the participants?	158
Evaluation Criterion 6: What were the most useful functions of the GIS?.....	161
Evaluation Criterion 7: Will participants be able to use GIS in future?	162
7.4 Landcare Illawarra WebGIS	163
Chapter 8: Discussion	165
8.1 Response to the Research Question	165
8.2 Evaluating the usefulness of GIS to participants in each case study	169
Evaluation Criterion 1: Was the GIS information provided easy to use and/or interpret?	169
Evaluation Criterion 2: Did the GIS assist the participant in their role, or help them in any way?	170

Evaluation Criterion 3: Did the GIS have an impact on decisions being made or opinions of the participants?	171
Evaluation Criterion 4: Were participants comfortable with using the GIS?	172
Evaluation Criterion 5: Did the GIS meet the expectations of the participants?	172
Evaluation Criterion 6: What were the most useful functions of the GIS?.....	173
Evaluation Criterion 7: Will participants be able to use GIS in future?	173
8.3 Limitations of this Research	176
8.4 Recommendations for Future Research	179
8.5 Conclusions.....	180
References.....	184
Appendices.....	194

List of Figures

Figure 1: Location of Kiama Local Government Area on the south coast of New South Wales and of Jamberoo, Minnamurra, Kiama, Gerringong and Gerroa urban centres.	38
Figure 2: Map of the Illawarra region	48
Figure 3: Layer 1 of GIS data presented to Jamberoo Public Meeting.....	52
Figure 4: Layer 2.....	53
Figure 5: Layer 3.....	53
Figure 6: Layer 4.....	54
Figure 7: Layer 5.....	54
Figure 8: Layer 6.....	55
Figure 9: Layer 7.....	55
Figure 10: Map illustrating flood prone land, as created by the Jamberoo focus group.....	57
Figure 11: Map illustrating active farming land, as created by the Jamberoo focus group.....	57
Figure 12: Map illustrating walking areas, as created by the Jamberoo focus group.....	58
Figures 13 and 14 Map of Acid Sulphate Soils layer as provided by Kiama Council (left) and that corrected at University of Wollongong (right). Legend colours used in the original maps produced by Department of Land and Water Conservation in 1998 were used here.	60
Figure 15: Coverage of vegetation mapping digitised at University of Wollongong.	61
Figure 16: Map of Rural Land use as reproduced from (Gilmour 1997).	62
Figure 17: Dairy Farm land in Kiama LGA, as mapped by Rural Kiama Inc.....	64
Figure 18: Map of Urban Release Areas in Kiama LGA.	65
Figure 19: Map illustrating Viewshed of Sandy Wha Estate Park	66
Figure 20: Viewshed of Sandy Wha Estate in ArcScene®	66
Figure 21: Map illustrating Viewshed of Mt Pleasant Lookout facing south.....	67
Figure 22: Viewshed of Mt Pleasant lookout facing south in ArcScene®.....	67
Figure 23: Screen capture of the GIS Maps Information Page of the Kiama WebGIS.	72
Figure 24: Screen capture of Kiama Local Government Area GIS in the Kiama WebGIS	74
Figure 25: Screen capture of a catchment scale GIS in the Kiama WebGIS.....	74
Figure 26: Screen capture of a town scale GIS in the Kiama WebGIS	75
Figure 27: Screen capture of the “Help” menu in the Kiama WebGIS	75
Figure 28: Example of a map in the Kiama WebGIS illustrating Land Zoning in the township of Kiama.....	76
Figure 29: Screen capture of the survey form in Kiama WebGIS.....	79
Figure 30: An example of a map produced by participants in the GPS tutorial.	86
Figure 31: Map of Land capability data acquired from Department of Natural Resources showing Landcare Illawarra area and the 3 tiles of data required for the area.	89
Figure 32: Map of Land Capability for Landcare Illawarra area as edited for use in the Community GIS.	89
Figure 33: Map of project sites and mapped weed locations produced by Werri Beach Dunecare group members for inclusion in the Community GIS.....	90
Figure 34: Screen capture of Landcare Illawarra area GIS menu in the Landcare Illawarra WebGIS.....	93
Figure 35: Screen capture of a Local Government Area scale GIS menu in the Landcare Illawarra WebGIS	93
Figure 36: Screen capture of Killalea State Park showing occurrence of State Environmental Planning Policy Wetlands and Littoral rainforest.....	94
Figure 37: Screen capture of Landcare Illawarra’s website which contains information about the Landcare Illawarra Community GIS Project and a link to the WebGIS.	94
Figure 38: Screen capture of the survey form in the Landcare Illawarra Community GIS website.....	96
Figure 39: Representation of Kiama Local Government Area townships on the Kiama Community Panel... ..	113
Figure 40: Was the GIS information presented easy to use and/or interpret?	117
Figure 41: A Screen Capture of the GIS showing colours in the Zoning map.....	119
Figure 42: Number of Kiama Community Panel members who found the GIS assisted them to participate..	120
Figure 43: Impact of the information presented in the Community Panel on the opinions of Community Panel members regarding planning issues in Kiama municipality.....	124
Figure 44: Impact of the GIS on the opinions of Community Panel members regarding planning issues in Kiama municipality	124

Figure 45: Map of proposed development in Gerringong prepared with input from panel members.....	126
Figure 46: Most useful function of the GIS to the Community Panel members.....	128
Figure 47: Map illustrating lot size categories for Kiama township as requested by Kiama Community Panel	131
Figure 48: Source of information regarding environmental issues in the Illawarra, as nominated by project participants.....	139
Figure 49: Environmental issues of most concern to project participants	140
Figure 50: Participants' rating of the tutorial presenter after each of the four GIS tutorials as number of respondents.....	142
Figure 51: Participants' rating of the tutorial presenter after each of the four GIS tutorials as percentage breakdown	142
Figure 52: Participants' rating of the use of a data projector in each of the four GIS tutorials as number of respondents.....	144
Figure 53: Participants' rating of the use of a data projector in each of the four GIS tutorials as percentage breakdown	144
Figure 54: Participants' rating of the printed tutorial notes provided in each of the four GIS tutorials as number of respondents.....	145
Figure 55: Participants' rating of the printed tutorial notes provided in each of the four GIS tutorials as percentage breakdown	145
Figure 56: Participants' rating of the amount of information provided in each of the four GIS tutorials as number of respondents.....	146
Figure 57: Participants' rating of the amount of information provided in each of the four GIS tutorials as percentage breakdown	146
Figure 58: Participants' rating of the amount of time allowed to complete each of the four GIS tutorials as number of respondents.....	148
Figure 59: Participants' rating of the amount of time allowed to complete each of the four GIS tutorials as percentage breakdown	148
Figure 60: Participants' rating of level of difficulty of each of the four GIS tutorials as number of respondents	149
Figure 61: Participants' rating of the level of difficulty of each of the four GIS tutorials as percentage breakdown	149
Figure 62: Level of difficulty versus previous GIS experience in Tutorial 1.	150
Figure 63: Level of difficulty versus previous GIS experience in Tutorial 4.	150
Figure 64: Level of difficulty versus level of education in Tutorial 1.	151
Figure 65: Level of difficulty versus level of education in Tutorial 4.	151
Figure 66: Survey respondents who think the GIS will help them or their Landcare group.....	153
Figure 67: Vegetation locations at Elizabeth Brownlee Reserve mapped by two research participants.....	155
Figure 68: How participants felt about using GIS in each tutorial as number of respondents.....	156
Figure 69: How participants felt about using GIS in each tutorial as percentage break down.	156
Figure 70: Reason for participating in the Landcare Illawarra Community GIS Project.....	158
Figure 71: Expectations of the project for self.....	159
Figure 72: Expectations of the project for Landcare groups.....	160
Figure 73: Most useful GIS function for project participants.....	161

List of Tables

Table 1: Advantages of citizen participation in government decision-making (after Irvin and Stansbury 2004).	6
Table 2: The Spectrum of Public Participation (International Association of Public Participation)	10
Table 3: Summary of Leitner's Models for Public Participation GIS	19
Table 4: Traditional division of environmental management responsibilities in Australia (after Oliver and Whelan (2003)).	35
Table 5: Kiama Local Government Area – Population Change, 1961 to 2001	40
Source: ABS Census table B01, 1961, 1966, 1971, 1976, 1981, 1986, 1991, 1996, 2001. (includes overseas visitors).	40
Table 6: Summary of GIS data layers prepared for use in the Community Panel.	63
Table 7: Summary GIS data layers prepared for Community Panel presenters	68
Table 8: GIS data available for viewing at Kiama Local Government Area scale, Catchment Scale and township scale in the Kiama WebGIS.	73
Table 9: GIS data available for viewing at Landcare Illawarra area scale and Local Government Area scale in the Landcare Illawarra WebGIS.	91
Table 10: Items of difference in the two approaches to PPGIS.	166
Table 11: Application of evaluation criteria to each case study.	175

List of Photos

Photo 1: Aerial view of Minnamurra catchment.	39
Photo 2: The Community Panel presented its report to Kiama Council.	45
Photo 3: Landcare members participating in the Mapping Exercises	85
Photo 4: Landcare members participating in the GPS Field Day	87
Photo 5: Landcare members participating in GIS Tutorials	88

Abstract

Geographic Information Systems (GIS) have traditionally been used by government agencies engaged in land use planning. As public participation in environmental decision-making has increased in recent times, so has use of Public Participation Geographic Information Systems (PPGIS).

This research addresses the current debate regarding PPGIS and its effects on public participants in environmental decision-making processes by comparing the “top-down” and “bottom-up” approaches to providing participants with access to GIS. A set of criteria for evaluating these two approaches were developed and applied to two case studies: (1) Was the GIS information provided easy to use and/or interpret?; (2) Did the GIS assist the participant in their role or help them in any way?; (3) Did the GIS have an impact on decisions being made or opinions of participants?; (4) Were participants comfortable using GIS?; (5) Did the GIS meet the expectations of the participants?; (6) What were the most useful functions of the GIS?; and (7) Will participants be able to use GIS in future?

The two case studies were based in the Illawarra region on the south-east coast of Australia. The Kiama Local Environment Plan (LEP) Review was a case study using the “top-down” approach, where a Community Panel of sixteen citizens of the Kiama municipality were provided with facilitated access to Kiama Council’s GIS data to propose a series of recommendations for inclusion in the new LEP. The Landcare Illawarra Community GIS Project was a case study in the “bottom-up” approach where members of Landcare groups in the Illawarra region were provided with GIS software, data and training to assist them to plan, conduct and evaluate their existing projects.

The research found that participants in each case study found the GIS easy to use. Participants in the Landcare case study felt empowered by the GIS because they were able to input their own data, while empowerment of participants in the Kiama LEP Review was dependent on how the Community Panel was facilitated. GIS impacted on the planning decisions made by participants in both case studies. Participants in the Landcare case study

who had hands on experience with the GIS, were comfortable with using the technology, gained familiarity with the software during a training course and quickly applied it to their own ends. The most useful functions for Kiama participants were framed in terms of how it assisted them to access the information they required, while Landcare participants noted many of the technical functions such as the ability to input data from a GPS, to calculate areas and to query data as the most useful functions.

WebGIS sites were developed for each case study, but the lack of adequate feedback from webGIS users meant that the use of GIS by website participants could not be evaluated as part of this research. Also, while the Landcare case study participants have ongoing access to GIS, it is difficult to determine whether Landcare members will continue to use it given the current lack of technical support.

Acknowledgements

I thank my supervisors, Professor Colin Woodroffe and Dr Nicholas Gill for their guidance and support through the duration of this research and other concurrent life projects.

I am grateful to many other people at the University of Wollongong who have assisted me immensely during the course of this work. In particular I would like to thank Heidi Brown, who was particularly helpful and generous with her time and great expertise throughout the entire research project, and Pat Muir who provided me with insightful thoughts and comments as I neared completion of this thesis.

I am also grateful for the generous support of Kiama Municipal Council and the Southern Rivers Catchment Management Authority for funding the research described in this thesis. In particular I would like to thank Andrew Knowlson and Peter Nelson of Kiama Council and Jane Caldwell of the Catchment Management Authority.

I cannot overstate my gratitude to the participants in my research. The Kiama Community Panel members were most accepting of me as they participated in this demanding exercise. The Landcare Illawarra Management Committee were most enthusiastic about this project, and assisted with contacting members of Landcare groups in the region to invite them to participate in my research. Of particular note I would like to thank Mike Swanson, Barbara Mathie, Ruth Jensen and Amanda Hogbin.

To my family and friends whose encouragement and support have remained constant. My husband, Simon, my parents, Margaret and Geoff and my sisters Megan and Clare have all provided me with the encouragement and support that enabled the completion of this thesis. Most of all I thank my beautiful baby girl, Amelia, who came into my life two years into this research project, full of all the good things that remind me of my priorities and to keep things in perspective.