UNDERSTANDING THE CONCEPT AND PRACTICE OF ECOSYSTEM APPROACHES TO HEALTH IN THE CONTEXT OF PUBLIC HEALTH

A thesis
Presented to
The Faculty of Graduate Studies
of
The University of Guelph

by
VI NGUYEN

In partial fulfillment of requirements
for the degree of
Master of Science
April, 2011

© Vi Nguyen, 2011
ABSTRACT

UNDERSTANDING THE CONCEPT AND PRACTICE OF ECOSYSTEM APPROACHES TO HEALTH IN THE CONTEXT OF PUBLIC HEALTH

Vi Nguyen
University of Guelph

Co-advisors
Dr. Andrijana Rajić
Dr. Scott McEwen

A scoping study of the published literature was used to describe the concept and practice of ecosystem approaches to health (ecohealth) in the context of public health. Analysis of commentaries identified 24 themes, expressed in a mind map showing interconnections between themes, with a table of explanations. Most (27 of 29) primary research articles did not explicitly explain how ecohealth was applied in their research, suggesting a need for some standardization in reporting ecohealth. Additionally, a case study approach was undertaken to identify enablers and impediments of ecohealth and how concepts were integrated into a research project of health and environmental sanitation in Vietnam. The project’s conceptual framework was aligned with ecohealth concepts, but in practice, a variety of challenges were identified. In future, ecohealth research teams should include a self-investigation of their ecohealth process to facilitate a comparison of theory-to-practice; this may serve as a best practice for ecohealth.
ACKNOWLEDGEMENTS

This thesis would not have been possible without many of the people I have met throughout graduate school. I would like to thank my co-advisors, Drs. Andrijana Rajić and Scott McEwen, and committee member, Dr. Craig Stephen for their time, guidance, support and pushing me to think critically and giving me the opportunity to gain a variety of valuable skills throughout this research. I will carry these as I journey through the exciting career I have ahead of me. Of course, none of this would have been possible without the support of the funders, the Public Health Agency of Canada (PHAC) and the Canadian Community of Practice in Ecosystem Approaches to Health (CoPEH-Can). Members of both organizations, of which there are too many to name here, have made a significant contribution to my personal and professional development throughout my studies through their mentoring, whether it was brief or long-term.

I am grateful to the staff at the Centre for Coastal Health, Drs. Jane Parmley, Kent Hecker, Tyler Stitt, and Lea Nogueira Borden for their help with the development of the relevance screening tools for scoping review in this thesis. Janet Harris provided literature searching expertise, an asset as I developed the search strategy. I also received invaluable support from Dr. Barbara Wilhelm, Kyle Burgers, Nanky Rai, Sherilee Harper, and Dr. Ian Young as reviewers for the relevance screening stage.

Chapter 3 took me on an exciting adventure to Vietnam, made possible through the support of Drs. Jakob Zinstagg, Hung Nguyen Viet, and their research team, Drs. Pham Duc Phuc, Khuong Nguyen, and Tu Van Vu, Nga Thu...
Do, Nhung Hong Nguyen, and Nhi Phuong Truong. I would like to thank the Swiss Tropical and Public Health Institute, Hanoi School of Public Health (in particular, the Department of Environmental Health), and National Institute of Hygiene and Epidemiology, for their in-kind contributions. I would also like to thank all of the research participants from both communes for sharing insights into the research process.

I really appreciate my fellow graduate students, friends, and staff at PHAC, OVC, and those that I met through the CoPEH-Can, who have made my time memorable. To all of my friends, family, and Andrew Lee, I thank you for the love and support you have given me through this journey.
# TABLE OF CONTENTS

## CHAPTER ONE: Introduction, Study Rationale, and Objectives

The move towards more holistic approaches in public health .............................. 1
The current state of ecohealth............................................................................... 3
The need for a scoping study of the ecohealth research field .............................. 6
The Analysis Method Framework for the analysis of textual qualitative data........ 7
The use of case studies to gain better understanding of an issue ......................... 8
Study rationale...................................................................................................... 9
Study objectives .................................................................................................. 10
References...........................................................................................................11

## CHAPTER TWO: Defining the concept and practice of ecohealth within the context of public health – A scoping study

ABSTRACT ........................................................................................................ 19
INTRODUCTION ................................................................................................. 21
MATERIALS AND METHODS............................................................................. 23
  Principles of the Scoping study (ScS) ............................................................. 23
  Development of a study question .................................................................. 24
  Identification of potentially relevant literature .............................................. 24
    Search Terms and Strategy ......................................................................... 24
  Relevance screening and exclusion criteria ................................................... 26
  Article Analysis .............................................................................................. 27
    Commentary Articles.................................................................................... 27
    Primary Research Articles.......................................................................... 28
RESULTS........................................................................................................... 28
  Literature search and relevance screening .................................................... 28
CHAPTER THREE: Case study of health and environmental sanitation in Hanam, Vietnam: Identifying the enablers and impediments of ecohealth

ABSTRACT ........................................................................................................ 62

INTRODUCTION ............................................................................................. 63

MATERIALS AND METHODS ......................................................................... 65

Study Approach ............................................................................................. 65

Study Design ................................................................................................. 66

Identification of the system under study ....................................................... 66

Entry into project site .................................................................................... 66

Selection and recruitment of participants .................................................... 67

Data collection ............................................................................................... 68

Translation and transcription ........................................................................ 70

Data Analysis ............................................................................................... 70

RESULTS ........................................................................................................... 71

Description of the case and context .............................................................. 71

Interviews and focus groups ......................................................................... 72

DISCUSSION ..................................................................................................... 74

CONCLUSION .................................................................................................... 84

ACKNOWLEDGEMENTS ................................................................................... 85
REFERENCES................................................................................................................. 86

CHAPTER FOUR
SUMMARY DISCUSSION AND CONCLUSIONS ................................................... 117
REFERENCES............................................................................................................... 123

APPENDICES

Chapter Two: Scoping review

Appendix 2.1 The finalized search strategy with tailored algorithms for each database......................................................................................................................... 127
Appendix 2.2 Relevance Screening Tool I – Dec. 18, 2008 ...................................... 132
Appendix 2.3 Relevance Screening Tool II for Commentaries – Dec. 18, 2008 134
Appendix 2.4 Analysis Method Framework ................................................................ 135
Appendix 2.5 Data extraction tool for primary research that explicitly stated using an ecosystem approach, within the context of public health.......................... 138
Appendix 2.6 Commentaries (n=24) analyzed using the analysis method framework and primary research articles (n=29) extracted using the data extraction tool............................................................................................................. 144

Chapter Three: Case study

Appendix 3.1 Interview questions for post-doctoral fellow and project lead of the NCCR research team.............................................................. 149
Appendix 3.2 Interview questions for graduate students of the NCCR research team.......................................................................................................................... 153
Appendix 3.3 Interview questions for the Head of Health Station and health staff workers in Nhat Tan and Hoang Tay Communes............................................. 158
Appendix 3.4 Focus group questions for community members and village health workers in Nhat Tan and Hoang Tay Communes........................................... 162
Appendix 3.5 Information letter and consent form for research participants (English version).................................................................................................................. 167
Appendix 3.6  Information letter and consent form for research participants

(Vietnamese version)........................................................................................................... 170

Appendix 3.7  Analysis Method Framework ................................................................. 172
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1.1</td>
<td>A comparison of the characteristics of systematic and scoping reviews.</td>
<td>16</td>
</tr>
<tr>
<td>Table 1.2</td>
<td>Steps in Analysis Method Framework used for synthesis of commentaries on ecohealth.</td>
<td>17</td>
</tr>
<tr>
<td>Table 1.3</td>
<td>Process used for conducting case study research on ecohealth.</td>
<td>18</td>
</tr>
<tr>
<td>Table 2.1</td>
<td>Databases used for literature search of scoping study and the numbers of electronic hits after de-duplication.</td>
<td>47</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Features of relevance screening (RS) forms 1 and 2 used to identify and categorize potentially relevant commentary and primary research articles.</td>
<td>48</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Steps in Analysis Method Framework used for commentaries.</td>
<td>50</td>
</tr>
<tr>
<td>Table 2.4</td>
<td>Information categories and data extracted from 29 relevant primary research articles.</td>
<td>51</td>
</tr>
<tr>
<td>Table 2.5</td>
<td>Themes and their explanations that emerged from analysis of 24 commentaries on ecohealth using the analysis method framework.</td>
<td>52</td>
</tr>
<tr>
<td>Table 2.6</td>
<td>General characteristics, methods, and outcomes of 29 relevant primary research articles.</td>
<td>55</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Case study data collection methods, language of delivery and purpose of questions, by stakeholder group.</td>
<td>110</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Steps in analysis method framework used for analysis of interview and focus group responses.</td>
<td>112</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Description of major elements of graduate student sub-projects within the health, social, and environmental research components of the National Centre for Competance in Research North-South (NCCR) project.</td>
<td>113</td>
</tr>
<tr>
<td>Table 3.4</td>
<td>Identified themes with groundedness 20 or greater from application of the analysis method framework to transcripts.</td>
<td>vii</td>
</tr>
</tbody>
</table>
of interviews and focus groups with different stakeholder groups................................................................. 115

Table 3.5 Themes with groundedness <20, relating to the nature of interaction and sharing of information among stakeholders and categorized as enablers and impediments of ecohealth for this case study................................................................. 121

Table 3.6 Input from community members on solutions, roles, and signs of improvement for health and environmental sanitation................................................................. 127

Table 3.7 Assessment of the case study project consistency with ecohealth components identified in Chapter 2......................... 128

Table 4.1 Proposed guidelines for reporting of the ecohealth process................................................................. 123
### LIST OF FIGURES

| Figure 2.1 | Numbers of abstracts and full papers evaluated at various stages of the scoping review of ecohealth | 58 |
| Figure 2.2 | Mind map showing the categories, themes, and interconnections between concepts in ecohealth | 59 |
| Figure 3.1 | Conceptual framework of the combination of health and environmental risk assessment for health and environmental sanitation planning | 132 |
| Figure 3.2 | Open drainage system (left) and Nhue River containing untreated wastewater flowing from Hanoi (right) in Hoang Tay Commune, Kim Bang District, Hanam Province, North Vietnam | 133 |
| Figure 3.3 | Environmental, social, economic, and health aspects of the problem from a research perspective | 134 |
| Figure 3.4 | Stakeholders affected by the issues of environmental sanitation and related to the NCCR research project | 135 |
CHAPTER ONE

INTRODUCTION, STUDY RATIONALE AND OBJECTIVES

The move towards more holistic approaches in public health

“Ecohealth can be defined as systemic, participatory approaches to understanding and promoting health and wellbeing in the context of social and ecological interactions” (Waltner-Toews, 2009). This approach has evolved from the notion that health and well-being are influenced by factors internal and external to our ecosystems (CoPEH Canada, no date (n.d.)). Ecohealth is the abbreviated term for ecosystem approaches to health. It is an integrative approach to addressing health and environmental issues and is distinguished by the focus on participatory and interdisciplinary research that addresses equity (CoPEH Canada, n.d.). The approach brings together stakeholders from a variety of disciplines and sectors, as well as policy and decision-makers and those affected by the issue of interest (CoPEH Canada, n.d.).

Effective multi-sectoral collaboration and engagement of multiple types of stakeholders are challenges for public health shared by many fields, including environmental management (Brown, Mackensen, & Rosendo, 2005). The ecosystem approach was proposed initially by scientists working on the International Joint Commission in the Great Lakes and developed further by the Convention on Biological Diversity as a broad framework for addressing these challenges in the Millennium Ecosystem Assessment (MEA), a recent international assessment of changes occurring in ecosystems and their effect on
human well-being. The MEA, called for by the United Nations (UN) Secretary General in 2000, was led by a Board made up of representatives from five international conventions, five UN agencies, international scientific organizations, governments, and leaders from the private sector, nongovernmental organizations, and indigenous groups (Brown et al., 2005; MEA, 2005). Within the MEA and other activities, attention has been drawn to broader and more holistic thinking because it is often quite difficult to deal with public health issues in isolation, without consideration of the broader system within which the problem is embedded. In a foreword for the Health Synthesis section of the MEA (2005), Lee Jong-Wook, then Director General of the World Health Organization, emphasized that “environmental health now requires a broader lens because emerging health risks are not limited to localized exposures to “traditional” forms of pollution but rather result from broader pressures on ecosystems” (Corvalan, Hales, & McMichael, 2005). While some have emphasized its flexibility, the ecosystem approach has also been criticized by many for its limited usefulness and lack of clarity and practicality (Emerton, n.d.; Hartji & Klaphake, A. & Schliep, R., 2003; OECD Centre for Cooperation with Non-members, n.d.). Ecohealth, as discussed here, is distinguished from its earlier cousin, the ecosystem approach, as having more recently evolved towards greater emphasis on the social determinants of health (Webb et al., 2010).
The current state of ecohealth

As a distinct field of endeavour, ecohealth is relatively new, and the term “ecohealth” is increasingly used in the literature. It is a fairly active area, as indicated by the quantity of research publications and funding opportunities, as well as teaching portfolio development and knowledge dissemination. In Canada, the recent upsurge in activity has coincided with the establishment in 1996 of the Ecohealth Program by the Canadian International Development Research Centre (IDRC), the major global funder of ecohealth research, which spent $9, 536, 000 CAD on this program in 2009 (IDRC, 2009; IDRC, 2010c). The IDRC provides funding for ecohealth groups, such as the International Association for Ecology and Health (IAEH) and its associated journal, EcoHealth, an international, peer-reviewed journal launched in 2004 that combines ecological and health science knowledge and was the union of two complementary journals, Ecosystem Health and Global Change and Human Health (Anonymous, n.d.b).

There have been several international conferences on ecohealth over the last decade. The first International EcoHealth Forum was held in Montreal, Canada (2003), the second in Merida, Mexico (2008), and the third in London, UK (2010) (Anonymous, 2010; De Plaen & Kilelu, 2004; IDRC, 2010b). The EcoHealth ONE Conference (2006) in Wisconsin, USA founded the IAEH (EcoHealth Network, 2006). These conferences were instrumental in bringing together researchers, practitioners, policy-makers, and non-governmental organizations from a variety of perspectives and countries to discuss and share ideas on the research and practice of ecohealth.
One of the major outcomes of the first conference was support to the development of various Communities of Practice in Ecosystem Approaches to Health (CoPEHs) around the world. Internationally, these CoPEHs have been formed in response to increasing interest in ecohealth research (IDRC, 2010a). Many of these groups were supported by the IDRC. “A community of practice is a network made up of individuals and organizations that share common concerns or an interest in a particular topic or challenge, and who further each other’s goals and objectives in that specific topic area.” (IDRC, 2010a) In 2010, there were 5 regional CoPEHs located in Latin America and the Caribbean (CoPEH - LAC), Middle East and North Africa (CoPEH - MENA), Sub-Saharan Africa (CoPEH - SSA), Canada (CoPEH - Can), and South and South East Asia (CoPEH - SSEA) (Anonymous, n.d.a; IDRC, 2010a). They focus on the effects of toxic substances on health; improvement of water resources management in order to enhance human health and well-being; institutionalization of ecohealth and knowledge generation pertaining to the interface of the environment and health; training of graduate students and professionals through targeted ecohealth research; and the emergence and re-emergence of infectious diseases, respectively.

The promotion of ecohealth concepts through continuing education and targeted training workshops is another method of knowledge dissemination that has received attention from academic institutions over the past decade. These concepts have been integrated into the teaching of health and environmental sciences at the University of Newcastle, New South Wales, the medical curricula
at the University of Western Ontario and the University of Hawaii John A. Burns School of Medicine, various veterinary schools across Canada and at the University of Illinois, and global health programs at the University of Pittsburgh School of Public Health (Howard, 2004). In 2008-10, there were also short training courses on ecohealth for graduate students in Canada delivered through the CoPEH-Can and sponsored by the IDRC (CoPEH Canada, n.d.). In these venues, ecohealth concepts were taught in a variety of ways, including case-based techniques, lectures, panel discussions, field experiences, and elective courses (Lannigan, 2004; Waltner-Toews et al., 2004; Wilcox & Kasuya, 2004). Some of these approaches incorporate topics from other disciplines in order to encourage broader thinking within the discipline under study.

Along with the research and teaching activities in ecohealth, monitoring and evaluation of the process of and outcomes of ecohealth research are also important (IDRC, 2005). There is, however, relatively little published research on evaluation of ecohealth and the examination of projects in-progress to determine their consistency with ecohealth concepts (Sherwood, Cole, & Crissman, 2007). A recently published article by Boischio and colleagues (Boischio, Sánchez, Orosz, & Charron, 2009) discussed challenges and opportunities of ecosystem approaches in prevention and control of dengue and Chagas disease. However, this was a discussion based on their experience with the IDRC’s Ecohealth Program Initiative rather than a project evaluation per se. The IDRC has emphasized outcome mapping for ecohealth evaluation (IDRC Evaluation Unit, 2005; IDRC, 2005); as the name suggests, this method focuses on outcomes,
instead of impacts, to appreciate how and why the desired results are found. In this context, outcomes are defined as “changes in behaviour, relationships, activities, or actions of people, groups, and organizations with whom a program works for”, as opposed to impact, which is defined as “a sustainable improvement in the environment or in the well-being of a large number of targeted beneficiaries” (Earl, Patton, & Smutylo, 2001). Diverting focus from impact is intended to prevent evaluations conducted on the premise that an issue and its solution have a linear cause and effect relationship. The application of outcome mapping to projects in progress is of course challenging, especially early on when there has been insufficient time to achieve project outcomes.

The need for a scoping study of the ecohealth research field

Knowledge synthesis (KS) methods, such as systematic reviews, have become increasing important approaches for transparent and standard identification, evaluation, compilation and summarization of publicly available and sometimes even unpublished (grey) literature underpinning a question of interest (Graham et al., 2006; Sargeant, Amezcuja, Rajic, & Waddell, 2005; Borenstein, Hedges, Higgins, & Rothstein, 2009). Systematic review and meta-analysis are the most known and frequently used KS methods. Systematic reviews are used to identify, critically appraise and summarize or synthesize existing research data underpinning focused and well-defined questions in clinical medicine and public health. Meta-analysis is often used to quantitatively synthesize data from a pool of sufficiently similar studies and generate more precise summary effects.
(Graham et al., 2006; Borenstein et al., 2009; Crombie & Davies, 2009). In contrast, the scoping study, a relatively new KS method that is still in development and validation, is usually described as a semi-quantitative synthesis method, used for exploring and describing the amount, breadth, and characteristics of existing primary research pertaining to broad questions; the outcomes of which are applicable to knowledge translation and knowledge gap identification, and deciding if a systematic review is appropriate (Anderson, Allen, Peckham, & Goodwin, 2008; Arksey & O'Malley, 2005; Davis, Drey, & Gould, 2009). The main differences between the attributes of scoping studies and systematic reviews are shown in Table 1.1 (Brien, Lorenzetti, Lewis, Kennedy, & Ghali, 2010). Given the breadth of the ecohealth approach, a scoping study may be suitable for mapping out various dimensions of existing ecohealth research and better understanding of this concept.

The Analysis Method Framework for the analysis of textual qualitative data

Of the many approaches available for synthesis and analysis of qualitative data, the ones that use transparent and systematic principles are usually recommended. For example, the “analysis method framework” developed by the National Centre for Social Research in the 1980s is commonly employed for analyzing qualitative data and can be used for any type of textual data, regardless of context or research design; it is widely used in social policy research (Spencer, Ritchie, & O’Connor, 2003; Pope, Ziebland, & Mays, 2006). Some areas where this framework approach has been applied include:
“Qualitative follow-up of the British Gambling Prevalence Survey 2007” to provide further insight into participants gambling behaviour (exploring how, when, and why they do it, what they enjoy about it, downsides, where problem behaviour is an issue, and investigate causes and associated factors) and “The Drug Treatment Outcomes Research Study: Qualitative Study” to explore treatment providers’ and seekers’ perspectives on the factors influencing the effectiveness of drug misuse treatment in England (Barnard, Webster, O’Connor, Jones, & Donmall, 2009; Kerr et al., 2009).

The analysis method framework follows a systematic process with clearly defined steps, using a matrix to manage the data for each step (Spencer et al., 2003). It is used to draw out central themes, which are broken down into connected themes (Gibbs, 2010). Each of the former are organized in a matrix; each case/document with its own row and columns are used to summarize the latter. Each entry in the matrix is filled with relevant condensed data from the cases/documents. This provides a way for the analyst to search the data for patterns and connections. This framework is rigorous and transparent and allows the findings to be traced back to the original data (Spencer et al., 2003). The steps of the framework are presented in Table 1.2.

The use of case studies to gain better understanding of an issue

The nature of the research question is one of the main drivers for selection of the appropriate research method. A qualitative research design is primarily used to discover ‘in-depth’ dimensions and gain better understanding of
theoretical concepts and frameworks associated with a construct like ecohealth. This field offers many possibilities from which to choose; in social, behavioural, and health sciences five approaches are often used, including narrative research, phenomenology, grounded theory, ethnography, and case study (Creswell, 2007). In case study research, an issue is investigated using one or more cases within a setting or context. It is “viewed as a methodology, a type of design in qualitative research, or an object of study, as well as a product of the inquiry” (Creswell, 2007). The general steps of the process for conducting a case study are presented in Table 1.3. The researcher typically uses comprehensive data collection tools, drawing on a variety of sources of information (e.g. observations, interviews, audiovisual material, documents and reports) and the outputs consist of a case report and themes from the case (Creswell, 2007).

Study rationale

Despite considerable interest and activity surrounding ecohealth research and teaching in Canada and abroad, there remains a lack of clarity surrounding the concept and practice of ecohealth among practitioners, professionals as well as policy and decision-makers (Finkelman, MacPherson, Silbergeld, & Zinstaag, 2008; PHAC, 2009). It has been recognised that there is no formal paradigm for implementing ecohealth in practice (Waltner-Toews, 2009). While there is increasing use of the term ecohealth in the literature, many researchers do not explicitly describe their use of this approach and whether it improved health outcomes. Moreover, published studies often do not report whether ecohealth
pillars were required, utilized or applicable to their work. This weakens the capacity for a critical review of the utility of ecohealth in practice. All of these challenges indicate a need to review and analyse how researchers define and describe ecohealth and its implementation in the literature, and to investigate the implementation of such concepts through a case study.

**Study objectives**

The first objective of this research was to describe the concept and practice of ecohealth as it is used and referred to in the existing publicly available literature. Specifically, a scoping study was applied to identify common terms, definitions and explanations of ecohealth given in commentary articles and to describe characteristics of primary research in the area. A second objective was to identify, using a case study, the impediments and enablers of the application of ecohealth as well as conformity to the concepts of ecohealth in a project on health and environmental sanitation, using interviews and focus group discussion.
REFERENCES


Emerton, L. (n.d.). *Using an ecosystem approach: The integration of environmental concerns into decision making*


Table 1.1  A comparison of the characteristics of systematic and scoping reviews\textsuperscript{a}

<table>
<thead>
<tr>
<th>Systematic Review</th>
<th>Scoping Review</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Focused research question with narrow parameters</td>
<td>- Research questions(s) often broad</td>
</tr>
<tr>
<td>- Inclusion/exclusion usually defined at the outset</td>
<td>- Inclusion/exclusion can be developed \textit{post-hoc}</td>
</tr>
<tr>
<td>- Quality filters often applied</td>
<td>- Quality not an initial priority</td>
</tr>
<tr>
<td>- Detailed data extraction</td>
<td>- May or may not involve data extraction</td>
</tr>
<tr>
<td>- Quantitative synthesis often performed</td>
<td>- Synthesis more qualitative, and typically not quantitative</td>
</tr>
<tr>
<td>- Formally assesses quality of the studies and generates a conclusion related to the focused study question</td>
<td>- Used to identify parameters and gaps in a body of literature</td>
</tr>
</tbody>
</table>

\textsuperscript{a} From (Brien et al., 2010)
Table 1.2  Steps in Analysis Method Framework\(^b\) used for synthesis of commentaries on ecohealth

<table>
<thead>
<tr>
<th>Step</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identifying initial themes by reading the document, writing memos about the data, and creating a coding list with definitions</td>
</tr>
<tr>
<td>2</td>
<td>Labelling or tagging data by theme by applying the coding list to other documents and iteratively making revisions to the coding list for new themes that emerge</td>
</tr>
<tr>
<td>3</td>
<td>Sorting data by theme, each in a separate matrix that allows the reader to clearly see the data and the document from which it came</td>
</tr>
<tr>
<td>4</td>
<td>Summarizing and synthesizing data in another similar matrix that only captures the content and context</td>
</tr>
<tr>
<td>5</td>
<td>Identifying elements and dimensions, refining categories, classifying data in another matrix by reading the matrices from the previous steps and labelling the data to suggest what it represents</td>
</tr>
<tr>
<td>6</td>
<td>Detecting patterns by searching within and then across documents for linkages and repetition</td>
</tr>
<tr>
<td>7</td>
<td>Developing explanations by giving reasons that relate to the patterns found in the previous step</td>
</tr>
</tbody>
</table>

\(^b\) Adapted from (Spencer et al., 2003)
Table 1.3  Process used\textsuperscript{c} in for conducting case study research\textsuperscript{d} on ecohealth

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Explanation</th>
</tr>
</thead>
</table>
| 1    | Determine if case study approach is appropriate to the research problem | - need clearly identifiable cases with boundaries  
- seeks to provide an in-depth understanding of the cases or comparison of the cases |
| 2    | Identify cases | - may involve one or several individuals, a program, an event, or an activity  
- case can be single/collective, multi-sited/within-site, focused on a case or on an issue  
- uses purposeful sampling |
| 3    | Data collection | - detailed, in-depth from multiple sources  
- e.g. observations, interviews, audiovisual material, documents, reports |
| 4    | Analysis | - holistic analysis of the entire case or embedded analysis of a specific aspect of the case  
- analysis involves a detailed description of the case and analysis of themes within the case to understand complexity of the case (not for generalizing beyond the case) |
| 5    | Interpretation | - researcher reports of the meaning of the case (lessons learned) |

\textsuperscript{c} This process was used by our case study performed in Chapter 3

\textsuperscript{d} Adapted from (Creswell, 2007)
CHAPTER TWO

DEFINING THE CONCEPT AND PRACTICE OF ECOHEALTH WITHIN THE CONTEXT OF PUBLIC HEALTH – A SCOPING STUDY

ABSTRACT

Over the past decade, the term ‘ecohealth’ has been used increasingly in the literature; however, there remains some lack of clarity regarding its concept, practice, and measurable outcomes. Our objective was to undertake a scoping study of the publicly available literature and describe the concept and practice of ecohealth, within the public health context, using qualitative analyses. Relevance screening of 7543 abstracts and 596 subsequent full articles was conducted by two independent reviewers to identify and confirm relevant commentary and primary research articles. Twenty-four out of 47 commentaries and 29 primary research articles were selected for the analysis method framework to reach data saturation, and data extraction and descriptive summary, respectively. Analysis of commentaries resulted in 24 themes with a wide range of interconnectivity that were grouped into four categories: evolution of ecohealth, when ecohealth is employed, ecohealth in practice, and ecohealth pillars. Many of the commentaries that discussed these pillars did not clearly explain what these meant. Study design, outcomes and reporting characteristics were extracted from all primary research articles, 17 of which reported the use of ecohealth as a framework, but most (27 of 29) did not explicitly explain how transdisciplinarity, 1This manuscript was formatted according to the guidelines from the EcoHealth Journal.
participation and equity, the pillars of ecohealth, were actually used in their research. The results of this study suggest a need for some standardization in reporting ecohealth research, which may serve as a guide for subsequent design and evaluation of such work and result in enhanced and explicit evidence of the value of ecohealth by the wider scientific and policy communities.

Keywords: ecohealth, public health, concept, practice, scoping study, qualitative analysis
INTRODUCTION

“Ecohealth can be defined as systemic, participatory approaches to understanding and promoting health and well-being in the context of social and ecological interactions” (D. Waltner-Toews, 2009). It has evolved from the notion that health and well-being are influenced by factors in our ecosystems (CoPEH Canada, no date (n.d.)), hence the abbreviated term for ecosystem approaches to health.

Working across sectors and engagement of multiple types of stakeholders is a challenge for public health (Brown, Mackensen, & Rosendo, 2005). A cousin of ecohealth, the ecosystem approach, has been proposed as a broad framework for addressing these issues in the Millennium Ecosystem Assessment (MEA), a recent international assessment of changes occurring in ecosystems and their effect on human well-being (Brown, Mackensen, & Rosendo, 2005). The ecosystem approach has also been criticized by others for its limited usefulness, lack of clarity, practicality and measurable public health outcomes (Emerton, n.d.; Hartji & Klapheke, A. & Schliep, R., 2003; OECD Centre for Cooperation with Non-members, n.d.). Within the MEA (2005), then Director General of the World Health Organization, stressed that “environmental health now requires a broader lens because emerging health risks are not limited to localized exposures to “traditional” forms of pollution but rather result from broader pressures on ecosystems” (Corvalan, Hales, & McMichael, 2005). Over the past few decades,
reciprocal care of the environment and human health have also been exemplified in Principles 1 and 14 of the Rio Declaration and through prerequisites for health in the Ottawa Charter for Health Promotion, such as a stable ecosystem and sustainable resources (United Nations General Assembly, 1992; World Health Organization, 1986).

In recent years, the term ‘ecohealth’ is increasingly used in both primary research and commentary articles, the former presenting original data and the latter being mostly opinion-based or review articles discussing ecohealth but not presenting original data. This has coincided with the establishment of the Ecohealth Program at the Canadian International Development Research Centre (IDRC) (1996) and the Ecohealth Journal (2004) (Anonymous, n.d.; IDRC, 2010). Global ‘ecohealth’ advocacy has resulted in wide interests in these approaches in Canada but currently, many practitioners and decision makers are struggling with the ambiguity of the concept and there is confusion with other terms, like ecosystem health (PHAC, 2009). Thus, an examination of the literature on ecohealth could facilitate a better appreciation of the concept.

Knowledge synthesis methods are recommended for systematically identifying, evaluating, compiling, and summarizing literature on a given topic (Graham et al., 2006). In particular, the scoping study (ScS) is well-suited for broader topics, in contrast to the systematic review (SR), which is suited for focused questions (Arksey & O’Malley, 2005; Sargeant, Amezcuca, Rajic, & Waddell, 2005). ScSs explore the amount, breadth, and characteristics of
primary research supporting a broad area, are used to decide if SRs are warranted, and facilitate knowledge translation and identification of knowledge gaps (Anderson, Allen, Peckham, & Goodwin, 2008; Arksey & O'Malley, 2005; Davis, Drey, & Gould, 2009). Thus, ScS may be appropriate for better understanding of ecohealth.

Our objectives were: to identify and select relevant commentary and primary research articles on ecohealth using a ScS; to evaluate selected commentaries using an analysis method framework and identify main themes of eco-health ‘concept and practice’; and to extract and summarize the main characteristics of primary research reporting ecohealth practices within the context of public health.

MATERIALS AND METHODS

Principles of the Scoping study (ScS)

The ScS follows basic principles of synthesis research methodologies such as SR: 1) the development of a study question, 2) the development and pre-testing of search strategy to identify potentially relevant articles, 3) relevance screening (RS), and 4) data extraction (Sargeant et al., 2005). The first two steps were conducted simultaneously for both commentary and primary research articles (Figure 2.1). Relevance screening was performed using independent screening forms for commentary and primary research articles because their respective inclusion criteria were different (defining the concept vs. describing the
practice of ecohealth; this step is described below under “Relevance Screening”). Data extraction was applied only on primary research articles. Assessment of methodological soundness and reporting of primary research, otherwise commonly applied in SRs of relevant primary research (Sargeant et al., 2005), was not considered given the study objectives and the wide range of study designs, target populations, and outcomes anticipated in this ScS; moreover we did not intend to combine or synthesize the results to generate an overall effect estimate.

**Development of a study question**

The review began by assembling a team with experience in the areas of veterinary epidemiology, public health and synthesis research methodologies. Two research questions were developed *a priori* to achieve the study objectives:

1) How is ecohealth defined in a public health context based on publicly available literature? and 2) How is the ecohealth practice described and what outcomes are measured? The first question applied to review, opinion-based and commentary articles and the second to primary research articles.

**Identification of potentially relevant literature**

*Search Terms and Strategy*

An initial search for articles and websites on the topic of “ecohealth” was performed in the Google™ search engine. The keywords from 15 topic-related articles or websites were included into the search strategy. When no keywords were indicated, recurring terms were used. The search terms were grouped into
three categories, depending on whether they represented a population/contextual
situation, intervention, or outcome (Appendix 2.1). In particular, the search terms
specified human populations, terms used to describe ecohealth, and
human/public health, respectively, for these categories. Two search algorithms
were formed in order to capture some of the topic relevant articles located in the
initial search mentioned above. Individual search terms within and between these
categories were combined using the “OR” and “AND” Boolean operator,
respectively. Search terms were pre-tested in four selected databases by starting
with the entire search string and removing search terms one at a time (Table
2.1). If the number of search hits did not change, or the captured hits were not
relevant, the term was removed. Hits deemed to be relevant fell under the
specific categories described above. Initially, we found that the terms,
“ecosystem health” and “ecohealth” were used interchangeably, so both were
used in the search strategy.

Development of this search strategy was conducted in consultation with a
literature searching expert. The search was limited to the period 1970 to the
present because “the evolution of a new paradigm, ecosystem health, began with
the coining of the term “ecosystem medicine” in the late 1970s” (Rapport & Lee,
2004). The search strings were tailored for each database to accommodate
phrase searching. The four chosen databases (Table 2.1) indexed literature on
environmental science, ecology, and human/public health and journals that were
multidisciplinary. The finalized search strategy was implemented in June/July
2008 (Appendix 2.1). The selected databases and numbers of hits are displayed in Table 2.1. Search results were imported into the bibliographical management software Procite 5.0 (Thomson ResearchSoft, Philadelphia, PA) and de-duplicated.

**Relevance screening and exclusion criteria**

Abstract-level relevance screening 1 (RS 1) was used to identify potentially relevant primary research or commentaries published in English and investigating ecosystem health in the context of public health. Full articles that passed RS1 were evaluated (RS2) to confirm their relevance within the context of public health. At this level, commentaries were also classified by publication period and whether a description of ecohealth for commentaries was provided. Primary research articles were evaluated to confirm whether the authors explicitly stated using the ecohealth approach in their research. Terms used in the tools were supported by definitions, guidelines, or examples to enhance consistency among reviewers. The screening forms for RS1 and RS2, including definitions, are presented in Table 2.2 and Appendices 2.2 and 2.3, respectively. Inclusion of articles was limited to English language publications because of lack of financial resources for translation. A pre-test of the tools was done with the research team and the reviewers, prior to implementation. Each abstract or full article was reviewed independently by two reviewers and conflicts were resolved by discussion and consensus.
Article inclusion was limited to scientific journals and conference proceedings; whole publications such as books or entire conference proceedings were not included. In the case of articles that could not be located but deemed relevant by review of title or abstract, attempts were made to request full papers from the authors. The ScS was managed electronically using Systematic Review Software 4.0 (TrialStat! Corporation, Ottawa, ON).

**Article Analysis**

**Commentary Articles**

Textual descriptions of ecohealth were extracted from commentaries using a modification of the analysis method framework described in Table 2.3. The first step was adapted to provide guidance on coding themes and writing memos (Appendix 2.4) (Spencer, Ritchie, & O'Connor, 2003). This framework was pre-tested on five commentaries in conjunction with a team member and a PhD student with experience in qualitative data analysis. All of the themes identified initially by three independent pre-testers were the same, with slight differences in the codes used to explain the same concept, which was resolved by referring to memos written during coding and code or definition refinements. Due to this good agreement and resource constraints, the rest of the commentaries were coded by the first author only. Explanations of ecohealth were distilled from 24 selected commentaries until saturation of concepts was reached (Patton, 2002). The order in which commentaries were selected for analysis was somewhat random, but an attempt was made to include commentaries published in different years by
different authors, and a relatively larger proportion of articles published in the
EcoHealth Journal. The analysis was performed and managed using qualitative
data analysis software, ATLAS.ti 6.1. (ATLAS.ti GmbH, Berlin, Germany).

Primary Research Articles

Data from primary research publications were extracted using the Data
Extraction Tool for Primary Research and the data were managed in MS Excel
(Farrar, 2009; Sargeant et al., 2005) (Appendix 2.5). The tool was reviewed by a
professional with SR expertise and pre-tested on three primary research articles
by two review team members. The general categories of study details that were
extracted are presented in Table 2.4. The data were extracted by the first author
only, and then summarized by tabulating the data within the categories to
describe the practice of ecohealth reported in the literature.

RESULTS

Literature search and relevance screening

The numbers of abstracts and full articles at each stage of the ScS
process are displayed in Figure 2.1. Twenty-four relevant commentaries were
selected for analysis until data saturation was reached. Details on the practice of
ecohealth employed in the 29 relevant primary research articles and a summary
of each is presented in Appendix 2.6.
Commentaries

The themes identified (Figure 2.2 and Table 2.5) were grouped under four major categories: evolution of ecohealth, when ecohealth is employed, ecohealth in practice, and ecohealth pillars. The nodes emanating from the centre of the figure represent categories under which the themes were grouped.

Primary Research

General characteristics, methods and outcomes reported in the 29 relevant primary research articles are shown in Table 2.6. Ten (34%) articles were published in the EcoHealth Journal. The remainder were found in a variety of other journals ranging in scope from agriculture, various aspects of public health, international development, medicine, environmental management, veterinary medicine, and ecology. The list of first authors that published more than one of the 29 primary research papers include: Oscar Betancourt, Mariano Bonet, Martin J. Bunch, Marc Lucotte, Donna Mergler, Carlos Jose Passos, Jerry M. Spiegel, Robert B. Tate, David Waltner-Toews, and Annalee Yassi. All but one of the primary research articles were published between 2001 to 2008; there was one from 1981, most (12) were published in 2004 and 2005, and data collection took more than two years in 8 articles. The studies were performed in Africa, Asia, North America, and South America; Cuba and Mexico were grouped together with North America. Funding for the studies was provided in whole or in part by a variety of institutions, most frequently (66%) the IDRC. Many studies had multiple objectives, as shown in Table 2.6. The human health issues under
study were predominantly infectious diseases (48%), environmental health (79%), and social determinants of health (48%). Most of the studies were implemented at the community level (79%); the remainder were performed at the municipal (10%) and ecosystem levels (10%), with none analyzed at the state/provincial, national, or international level.

While 5 of the 29 studies used epidemiological study designs, 24 did not report use of any formal study design. Seventeen reported use of an ecosystem approach, one used a researcher-defined model, and the remaining 11 did not report using any framework (Table 2.6). The various methods, methodologies, and tools used by authors, as well as the stakeholders reported to be involved in the studies and their roles are also presented in Table 2.6.

In our study, outcomes were defined as results that the study authors reported in the “results” section of their paper. The reported outcomes were grouped together in broad categories based on commonalities among the outcomes (Table 2.6). This was necessary because there were many different outcomes due to different study areas and each study was placed-based and context-specific. While most studies (55%) did not report the means by which their study findings were disseminated to stakeholders, the other 45% used workshops and meetings.

One of the categories for data extraction of primary research was the description of the human population under study. This was difficult to describe because humans were always only one aspect of the issue under study and their
characteristics and demographics were often an outcome of the study, so were not described initially in the methods section. In most publications, descriptions of study populations typically did not go further than mentioning their source of livelihood and the geographical area where the issue of interest posed a problem for the communities, and from these descriptions, there did not appear to be any commonalities among the human populations under study.

**DISCUSSION**

Overall, most primary research articles (27/29) reported using an ecohealth framework, but did not give any explanation or methodological details that shed much light on what this meant in the context of their work, beyond citing the IDRC’s pillars of ecohealth (transdisciplinarity, participation, and equity) (Lebel, 2003). Thus, it is unclear from these studies how ecohealth was implemented in practice. Possible reasons for the lack of clarity include: journal space limitations, researchers perceiving that extensive discussion of the concepts elsewhere negated the need for explanation, or simply a lack of understanding of the approach. In their discussion of ecohealth in 2001, IDRC researchers Gilles Forget and Jean Lebel, called for better reporting of ecohealth studies. “If this approach is to be successful, the processes involved in developing projects, conducting the field work, assessing the early signs of untoward effects on the health of humans and ecosystems, collecting and processing data, and developing and carrying out interventions all need to be
better documented” (Forget & Lebel, 2001). Unfortunately, our review suggests that this advice has not been adhered to. Lebel is the author or co-author of some of the early documents on ecohealth that were cited by most other authors in the introductions of their research publications (Forget & Lebel, 2001; Lebel, 2003). An external review of the IDRC’s Ecohealth Program in November 2008, in referring to Forget and Lebel’s 2001 publication, pointed out that there have been “no further major publications of similar depth and scope, nor has there been a systematic review of the overall impact of the concept” and that “the concept should be updated as a matter of priority” (Finkelman, MacPherson, Silbergeld, & Zinstaag, 2008). This ScS, which captured primary research beyond the past decade, points out that little progress has been made on this recommendation. Thus, there is a need for development and use of standard reporting guidelines for studies where researchers claim to use ecohealth.

Of the studies examined in this review, those by Bunch (2003) and Neudoerffer, et al. (2005) are the only ones that explain the approach used, beyond citing what the literature says about ecohealth (Bunch, 2003; Neudoerffer, Waltner-Toews, Kay, Joshi, & Tamang, 2005). In Bunch’s paper, he used the “diamond diagram” (his Figure 2) as a framework for the approach, which has been presented in other publications, notably, The Ecosystem Approach: Complexity, Uncertainty, and Managing for Sustainability, which was written by many authors involved in ecohealth research and concept and theory development (Waltner-Toews, Kay, & Lister, 2008). This framework was
operationalized by adapting soft systems methodology (SSM) (Bunch, 2003, Figure 3) and adaptive environmental assessment and management. The tools and techniques used within workshops are explained in detail, including rich picture maps (Bunch, 2003, Figure 4), which “portray actors and elements in a problematic situation and indicates relationships among them”. Neudoerffer et al. (2005) applied ecohealth by adopting the Adaptive Methodology for Ecosystem Sustainability and Health (AMESH) (their Figure 3) and focused their article on one particular step, *Systems Descriptions and Narratives: Developing a Systemic Understanding*. They identified themes from analysis of qualitative data collected through focus groups, surveys, and participatory action research, which were used to draw issues and influence diagrams, portraying stakeholders, activities, resource states, needs, and concerns (themes they identified) and the relationship among them (their Figure 5). For specific details and the context of these studies, the reader is referred to Bunch (2003) and Neudoerffer, et al. (2005).

The analysis of most commentaries revealed that the pillars of ecohealth include: transdisciplinarity, equity, participation, systems, and sustainability. This is consistent with the definition of the IDRC (IDRC, 2005). However, in most commentaries examined, authors used these terms without explaining their meaning, perhaps for the same reasons as those behind the lack of explanation of the implementation of ecohealth in primary research articles. If, however, this actually reflects a lack of understanding of the ecohealth approach, then funders
and journals reviewers need to be wary of the increasing use of these terms over the last decade. The external review of the IDRC’s Ecohealth Program found that while ecohealth was commonly understood among stakeholders, the extent was vastly different in the West African, Southeast Asian, and Latin American regions, and “there were conceptual and operational differences in the understanding and application of the foundational elements of the concept (i.e. the pillars) across stakeholder groups” (Finkelman et al., 2008). This suggests that these concepts are not intuitive and our findings reinforce the need for improved explanation of ecohealth implementation in primary research articles.

The extent to which the pillars of ecohealth are incorporated into primary research articles is difficult to assess, but two papers examined in the scoping review actually attempted to explain their approach, and they provide some insights. First, the tools and outcomes of the variety of qualitative methods used by Bunch (2003) and Neudoerffer, et al. (2005), for example the rich picture maps and issues and influence diagrams, could be considered examples of transdisciplinarity. They incorporated the perspectives of many different stakeholders (those from the affected communities or working in different sectors) and a visual depiction of the issues shared by stakeholders was the result of the knowledge sharing or interaction. Thus, transdisciplinarity can be viewed as an emergent property of the interaction between stakeholders groups, practitioners, and/or researchers from different disciplines or sectors. This could be an outcome by which ecohealth is assessed. Second, the collaboration from
stakeholders in stages of problem identification and development of the research tools and outcomes mentioned above and their validation by stakeholders, is a form of participation that goes beyond simply collecting data from participants through surveys or similar methods. Third, systemic thinking in both of these studies involved going beyond linear cause-and-effect relationships that concentrate on pathogens and diseases to addressing the broader conditions (e.g. social, political, and cultural) of the problem. Fourth, equity, which is about accounting for differences between groups affected by the research problem, was incorporated by examining roles and responsibilities of stakeholders groups in the issues and influence diagrams and by giving weight to local knowledge as being as valuable as scientific knowledge (Bunch, 2003; Neudoerffer, et al., 2005). Sustainability is the remaining pillar but is much harder one to draw out from these articles.

We found a variety of terms in both commentaries and primary research articles that were used synonymously or interchangeably with ecohealth. These included: ecosystem approach, environmental health, ecologic approach, ecosystem health, and ecosystem management. This may reflect a lack of consensus on terminology, or perhaps a movement in both environmental and public health disciplines towards more holistic and integrative approaches over the last few decades, which is extensively reviewed by Forget and Lebel (Forget & Lebel, 2001).
The analysis of commentaries showed that ecohealth is intended for problems that are 1) long-term 2) complex 3) characterized by high uncertainty and 4) require action. It was difficult to tell whether primary research articles followed suit because we did not specifically set out to assess this; yet one could argue that all linear problems are embedded in complex systems, so the nature of any research problem may include these four components. However, this finding underscores that the specific research questions and methods used must also address these components in order for ecohealth to be applicable to the research problem.

The examination of reported outcomes from primary research articles revealed that they differed greatly between studies and could only be grouped into broad categories, probably due to the diversity of objectives among studies. This finding may reflect the “indicators” theme that emerged from the commentary analysis, which refers to measures used for outcomes or monitoring of the research process which should be developed by involved stakeholder groups and may be group-specific. Moreover, many of the categories that were extracted for the primary research were not mutually exclusive. This emphasizes the pluralistic nature of ecohealth; studies used a variety of methods and stakeholder perspectives, and studied different aspects of the problems of interest. This finding may echo the themes of “place-based”, “context-specific”, and that the “process” of conducting research needs to be “negotiated” with stakeholders, since each research problem was unique to a given context.
We had some difficulty describing the human population under study in all of the primary research articles. It may have been more relevant to extract details of the system under study (e.g. humans, animals, and the environment), but this would also be difficult to do since it was often one of the outcomes of their research. This highlights that ecohealth studies are usually place-based and context-specific.

Nearly half of the studies reported that results were given back to the community/stakeholders. This was accomplished through the use of meetings or workshops. While dissemination of results is an important part of ecohealth, it was unclear whether communities received the results in a useable form, and retained, learned, and acted on the information they were given. This is important to the knowledge translation process and should be reported. It is possible that such information was included in project reports to funding agencies, but not the peer-reviewed publications.

In this study, we used an analysis method framework on commentaries to identify themes important within the concept and practice of ecohealth. These themes were depicted in Figure 2.2, which also shows hypothesized interconnections. This figure is not intended to depict the only way of understanding ecohealth, but it arises from the way we searched and included literature. In our view, it is important to recognize that none of the individual themes are “new” concepts, but it is the bringing together of these into a process that makes ecohealth unique. Only two of the commentary articles actually
discussed a majority of these concepts together, those by Waltner-Toews (2001) and Forget and Lebel (2001). This could explain why many of the rest of the commentaries cite these two papers. These commentaries did not present ecohealth as a prescriptive process and highlighted that the concepts are not intuitive and that researchers should clearly explain their approach.

It is important to understand how to implement the ecohealth process. The theme “methodologies”, arising from the analysis of commentaries, indicates that there is a way to operationalize the concepts of ecohealth. SSM and AMESH were coded as “methodologies”, but since ecohealth is essentially about how research is conducted, these methodologies should not be viewed as the only ways of implementing ecohealth.

In any review of the literature, there is always the challenge of being comprehensive versus efficient. One of the possible limitations of this ScS was the exclusion of books and whole publications because of resource limitations. Unlike journal articles, these types of publications are not as constrained by word limits and have more room to describe the approach. Therefore review of these publications may have yielded differences with journal articles. However, ScS and SRs are traditionally limited to primary research, and inclusion of books would considerably lengthen the time required to conduct this ScS (Sargeant et al., 2005). Due to financial and time constraints, this ScS was limited to English language publications and it is possible that this affected the study findings. All non-English articles were excluded at RS1, the abstract level of screening, based
on English-only inclusion criteria, and thus it is unclear how many potentially relevant ones were captured by our search. The Community of Practice in Ecosystem Approaches to Health – Latin America and the Caribbean (CoPEH-LAC) is one of the most developed CoPEHs and their Spanish publications and those published in other languages might have made an important contribution to this review (CoPEH - TLAC, n.d.; Finkelman et al., 2008). Another challenge faced in this scoping review was the lack of standard terminology in describing ecohealth. We noted during the review that some authors didn’t use ecohealth search terms in their title, keywords or abstract, but rather in the body of the article, and thus would not be captured when searching. Others incorporated many of the themes identified by the analysis of commentaries but do not call their approach “ecohealth”. Search verification, which involves searching reference lists of primary and review articles and contacting experts to locate any articles not captured by the initial search strategy, was not done in our study due to the lack of standard terminology in ecohealth.

Further potential limitations of our analysis in this ScS lie in the lack of clarity of some definitions we extracted from commentaries on ecohealth. Most authors were probably not trying to directly answer the questions we sought in the analysis (i.e. What does ecohealth mean?). We sought definitions that actually gave an explanation, rather than just including ones that cited the IDRC’s pillars of ecohealth. Also, since many commentaries were based on opinions and experience of researchers working in this area, it is possible that the authors
assumed that ecohealth and its associated themes are widely and well-understood and that researchers know how to apply them in practice. The explanations we captured were, by no means, comprehensive definitions. Some of these themes encompass entire fields of study, methodologies, or concepts for which there are many schools of thought throughout scholarly publications.

Overall, the research findings point to the need for the development and use of standardized reporting for ecohealth research. In every established, mature field of study, there exists a set of concepts that are essential to understand, as well as tools, methods, and methodologies to guide practice. Over time, these become well-understood and do not need to be explained in primary research papers within established fields. However, the field of ecohealth is relatively new, and there is merit in researchers explicitly stating how their study methods and approach embody ecohealth. This issue is not unique to ecohealth; “global health” is an example of a field that shares this impediment (Stephen & Daibes, 2010) Such a reporting framework could itself be developed using ecohealth principles, and would need to be tested and gain consensus among those working on ecohealth research, and could serve as a guide for designing and evaluating this type of research. This may be of interest to funders, those publishing this type of research, and decision-makers.
CONCLUSION

The ScS of the literature on ecohealth within a public health context provided some clarification on concepts in ecohealth using an analysis of commentaries and identified a major issue with reporting of primary research through data extraction. Ecohealth is a process for dealing with long-term, complex problems that are characterized by high uncertainty and require action. It has evolved from both environmental and public health disciplines. Its core components are participation, transdisciplinarity, equity, systems thinking, and sustainability. In practice, the context of the problem involves the users defining the boundaries of the problem to study and the indicators to measure. These are place-based and context-specific. Some existing methodologies to implement the approach include, but are not limited to, Soft Systems Methodology and Adaptive Methodology for Ecosystem Sustainability and Health. The above-mentioned components should be negotiated between the people who affect and are affected by the issue of interest, within an iterative process. Understanding the meaning of ecohealth and how to apply it to complex problems is facilitated by understanding the evolution of the approach, recognizing when ecohealth is appropriate, understanding application of the core components, and understanding how the established methodologies and tools should be used to define the context of the study with affected stakeholders.
ACKNOWLEDGEMENTS

The authors would like to thank the researchers at the Centre for Coastal Health for their input and contributions to the development of the Relevance Screening Tools: Jane Parmley, Lea Nogueira Borden, Kent Hecker, and Tyler Stitt; Janet Harris for advice on search strategy development; Kyle Burgers for help with article procurement; Barbara Wilhelm, Sherilee Harper, and Nanky Rai for assistance with relevance screening; Ian Young for help with development of analysis tool for commentaries; and the Public Health Agency of Canada for funding this research.
REFERENCES


Emerton, L. (n.d.). *Using an ecosystem approach: The integration of environmental concerns into decision making*.


A guide for social science researchers (). Thousand Oaks, California: Sage Publications Ltd.


Table 2.1  Databases used for literature search of scoping study and the numbers of electronic hits after de-duplication

<table>
<thead>
<tr>
<th>Database (Source)</th>
<th>Number of Hits (De-duplicated within Database)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAB Direct (U of G¹)</td>
<td>1899</td>
</tr>
<tr>
<td>Environmental Sciences and Pollution Management (U of G¹)</td>
<td>4515</td>
</tr>
<tr>
<td>Medline (National Library of Medicine)</td>
<td>406</td>
</tr>
<tr>
<td>GreenFILE (Health Canada)</td>
<td>1823</td>
</tr>
<tr>
<td>Total</td>
<td>8643</td>
</tr>
<tr>
<td>De-duplicated (between databases)</td>
<td>7543</td>
</tr>
</tbody>
</table>

¹University of Guelph Library website was used to search these databases
Table 2.2  Features of relevance screening (RS) for MS 1 and 2 used to identify and categorize potentially relevant commentary and primary research articles

<table>
<thead>
<tr>
<th>Screening Level</th>
<th>Question</th>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract-level RS1 (commentaries and primary research articles)</td>
<td>1. Does this abstract investigate ecosystem health¹?</td>
<td>1. ecosystem health¹ primary research² or commentary articles in English, including training³ in this area</td>
<td>1. primary research² and commentary articles published in other languages but English, whole publications⁴ only, animal health⁵ only, environment or conservation only⁶</td>
</tr>
<tr>
<td></td>
<td>2. Does this abstract investigate ecosystem health¹ in the context of (check all that apply)?</td>
<td>2. ecosystem health¹ in the context of practices or programs⁵, human/public⁶ health, zoonoses⁷</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Description/explanation of ecosystem health¹ provided?</td>
<td>2. Yes</td>
<td>2. No</td>
</tr>
<tr>
<td></td>
<td>3. Ecosystem health¹ in a public health⁶ context?</td>
<td>3. Yes</td>
<td>3. No</td>
</tr>
<tr>
<td>Full article-level RS2 (primary research articles only)</td>
<td>1. Is the use of an ecosystem approach¹ stated in the title or body of the article?</td>
<td>1. Yes</td>
<td>1. No</td>
</tr>
<tr>
<td></td>
<td>2. Is the research performed in a public health⁶ context?</td>
<td>2. Yes</td>
<td>2. No</td>
</tr>
</tbody>
</table>

¹ Other terms used to indicate ecosystem health may include, but are not limited to: ecosystem approach, ecohealth, ecosystem management, and ecosystem medicine.
2 Primary research may include: a study where the authors collected and analyzed their own data papers OR a paper where the author used the ecosystem health approach in their design/methodology but there must be some sort of indication that their conclusions are verifiable using data/results, even if it isn’t reported in this article.

3 Training refers to a course/training delivered by a professional affiliated with an institution (e.g. educational, governmental, non-governmental organization [NGO]).

4 Whole publications include entire conference proceedings and books.

5 Practices or programs can be defined as a set of planned actions or a conceptual framework that has been or can be actually used or applied in a human/public health setting.

6 Human/public health refers to the science and practice of protecting and improving the health of individuals or a human community. The study must link the practice of ecosystem health to human/public health.

7 Zoonoses are diseases that can be transmitted between humans and animals (WHO 2008). The study must link the practice of ecosystem health to human/public health.

8 Animal health refers to the science and practice of protecting and improving the health of an individual or community of domestic or wild animals.

9 Environment or conservation only refers to papers on these topics where the authors do not link the practice of ecosystem health to human/public health.
Table 2.3  Steps in Analysis Method Framework used for commentaries

<table>
<thead>
<tr>
<th>Step</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identifying initial themes by reading the document, writing memos about the data, and creating a coding list with definitions</td>
</tr>
<tr>
<td>2</td>
<td>Labelling or tagging data by theme by applying the coding list to other documents and iteratively making revisions to the coding list for new themes that emerge</td>
</tr>
<tr>
<td>3</td>
<td>Sorting data by theme, each in a separate matrix that allows the reader to clearly see the data and the document from which it came</td>
</tr>
<tr>
<td>4</td>
<td>Summarizing and synthesizing data in another similar matrix that only captures the content and context</td>
</tr>
<tr>
<td>5</td>
<td>Identifying elements and dimensions, refining categories, classifying data in another matrix by reading the matrices from the previous steps and labelling the data to suggest what it represents</td>
</tr>
<tr>
<td>6</td>
<td>Detecting patterns by searching within and then across documents for linkages and repetition</td>
</tr>
<tr>
<td>7</td>
<td>Developing explanations by giving reasons that relate to the patterns found in the previous step</td>
</tr>
</tbody>
</table>

1Adapted from (Spencer, Ritchie, & O'Connor, 2003)
Table 2.4  Information categories and data extracted from 29 relevant primary research articles

<table>
<thead>
<tr>
<th>Category</th>
<th>Description of Extracted Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>General study details</td>
<td>Reference identification in Systematic Review Software</td>
</tr>
<tr>
<td></td>
<td>Journal name</td>
</tr>
<tr>
<td></td>
<td>Author name(s)</td>
</tr>
<tr>
<td></td>
<td>Publication year</td>
</tr>
<tr>
<td></td>
<td>Location of study</td>
</tr>
<tr>
<td></td>
<td>Year(s) during which the data were collected</td>
</tr>
<tr>
<td></td>
<td>Source(s) of study funding</td>
</tr>
<tr>
<td></td>
<td>Study objective(s)</td>
</tr>
<tr>
<td></td>
<td>Human health issue under study</td>
</tr>
<tr>
<td></td>
<td>Human/animal population under study</td>
</tr>
<tr>
<td></td>
<td>Study implementation setting</td>
</tr>
<tr>
<td>Methods</td>
<td>Reported study design/type</td>
</tr>
<tr>
<td></td>
<td>Framework(s) used/developed</td>
</tr>
<tr>
<td></td>
<td>Research methods used</td>
</tr>
<tr>
<td></td>
<td>Reported stakeholders involved</td>
</tr>
<tr>
<td></td>
<td>How stakeholders were involved</td>
</tr>
<tr>
<td></td>
<td>Evaluation methods used</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Reported outcomes (qualitative and quantitative)</td>
</tr>
<tr>
<td></td>
<td>How outcomes were measured</td>
</tr>
<tr>
<td></td>
<td>How study findings were disseminated to stakeholders</td>
</tr>
</tbody>
</table>

Additional comments on study
<table>
<thead>
<tr>
<th>Type of Theme</th>
<th>Theme</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Themes without categories</td>
<td>Process</td>
<td>- how the research is conducted, not the study topic, intervention or methodology</td>
</tr>
<tr>
<td>Categories only – were not themes, only used to group themes</td>
<td>When ecohealth is employed</td>
<td>- the type of issue for which ecohealth has been used for in the literature</td>
</tr>
<tr>
<td></td>
<td>Ecohealth in practice</td>
<td>- guidelines for implementing ecohealth</td>
</tr>
<tr>
<td></td>
<td>Ecohealth pillars</td>
<td>- concepts to guide understanding and practice in ecohealth</td>
</tr>
<tr>
<td></td>
<td>Defining study context</td>
<td>- required description by the group studying the research problem</td>
</tr>
<tr>
<td></td>
<td>Evolution of ecohealth</td>
<td>- ecohealth evolved from other disciplines, mainly public health and environmental sciences</td>
</tr>
<tr>
<td></td>
<td>Methodologies/tools</td>
<td>- ways to implement ecohealth; may include but not limited to: soft systems methodology, adaptive environmental assessment and management, and participatory action research</td>
</tr>
<tr>
<td></td>
<td>Participation</td>
<td>- from the beginning, stakeholders (including affected population) collaborate on various research stages using local knowledge and addressing some of their priorities; also refers to participatory action research</td>
</tr>
<tr>
<td></td>
<td>System</td>
<td>- understanding the whole and its parts (issues, interactions, key actors, components, and interrelationships); includes systems science</td>
</tr>
<tr>
<td>Themes only – were not used to group themes, grouped under categories</td>
<td>Ecosystem management</td>
<td>- management of the natural environment to preserve health of ecosystem and inhabitants (ecocentric)</td>
</tr>
<tr>
<td></td>
<td>Environmental health</td>
<td>- investigates environmental factors that affect human health (anthropocentric)</td>
</tr>
<tr>
<td></td>
<td>Multidisciplinary</td>
<td>- more than two disciplines working together in their traditional roles</td>
</tr>
<tr>
<td></td>
<td>Action-oriented</td>
<td>- results in something done to solve or mitigate the research problem under study</td>
</tr>
<tr>
<td></td>
<td>Complexity</td>
<td>- made up of many interrelated parts; where ecohealth is best applicable</td>
</tr>
</tbody>
</table>
### Uncertainty
- what you have when it is difficult to make predictions about the outcome

### Long-term
- ecohealth requires a time-commitment; improvements/outcomes might only be seen in the future; difficult to contain within a single project

### Boundaries
- of the system under study defined by what is sought to be achieved

### Placed-based
- ecohealth requires local participation to define its elements and relationships of interest in a given ecosystem, is rooted in culture and nature

### Context-specific
- relevant for the specific study situation or system

### Indicators
- measures used for study outcomes and monitoring should be developed by involved stakeholders and may be different according to each group

### Adaptive management
- an iterative learning process with stakeholder participation involving monitoring, evaluating, and adjusting the plan based on the information generated in the process

### Scenarios
- description of what the future could look like

### Transdisciplinarity
- collaboration between researchers and practitioners from complimentary disciplines/sectors and/or other stakeholders on a problem; uses multiple methods/tools that facilitate the generation of new frameworks, concepts, methods, institutions, etc. from the knowledge sharing and/or interaction

### Equity
- addresses differences between groups affected by research problem; gender (roles, responsibilities), power (decision making, access to resources), and trade-offs (who benefits)

### Sustainability
- meeting the needs of current generations without compromising the needs of future generations; the outcome or goal of ecohealth, also refers to sustainability of the environment and/or of interventions/projects

### Socio-ecological
- understanding the human and environmental components of a problem and their interaction
| SOHOs (self-organizing, holarchic open system) | - characterized by holarchy (interactions between nested hierarchies), feedback loops (consequences for another part of the system – positive or negative), self-organization (combination of feedback, boundaries, and openness) |
| Negotiate | - a process in which the decisions on objectives, methods, and indicators are made with stakeholders |
Table 2.6  General characteristics, methods, and outcomes of 29 relevant primary research articles

<table>
<thead>
<tr>
<th>Study characteristic</th>
<th>Categories</th>
<th>Number of papers</th>
<th>% of 29 papers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives of study</td>
<td>Assess an intervention</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Assessing health</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Developing tools/ methods/ frameworks to assess health</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Implement an intervention</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Manage/ rehabilitate an ecosystem and its members (includes human health)</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Understand community/ public/ stakeholder perspectives on the intervention/ problem</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Understand the aspects or context/ system surrounding the problem of interest</td>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td>Human health issue studied</td>
<td>Physical injuries/ accidents</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Chronic diseases</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Infectious diseases</td>
<td>14</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Environmental health</td>
<td>23</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>Social determinants of health</td>
<td>14</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Mental health</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Reported frameworks used</td>
<td>Ecosystem approach</td>
<td>17</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Researcher-defined model</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>No framework reported</td>
<td>11</td>
<td>38</td>
</tr>
<tr>
<td>Reported methods, methodologies, and tools used</td>
<td>Clinical/laboratory tests</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Mapping²</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous³</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Participant observation</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Stakeholders reported to be involved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participatory rural appraisal method (PRA)</td>
<td>11</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Stakeholder/community workshops/meetings</td>
<td>5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Survey/interviews/focus groups</td>
<td>14</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Agricultural, livestock, or environmental officials/organizations</td>
<td>5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Community leaders/representatives/gatekeeper</td>
<td>7</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Community members</td>
<td>29</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Educational officials/organizations</td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>External consultants (none of above categories) - field workers from another village, journalist</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Government/policy maker</td>
<td>10</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Health officials/organizations</td>
<td>14</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Industry/businesses</td>
<td>3</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Local organizations/groups (excluding businesses &amp; health-related)</td>
<td>5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Non-governmental organization (NGO)</td>
<td>6</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Researcher/scientist (academic or government)</td>
<td>14</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Applying interventions/research process</td>
<td>10</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Assessing interventions/research process</td>
<td>5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Defining/understanding the problem/research question(s)</td>
<td>10</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Designing interventions/research process</td>
<td>10</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Involved in all aspects of study/research</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Not reported</td>
<td>6</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Provided data</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Categories of outcomes reported in articles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demographics &amp; characteristics of study population/area</td>
<td>16</td>
<td>55</td>
<td></td>
</tr>
</tbody>
</table>

56
<table>
<thead>
<tr>
<th>Reported method of results dissemination to stakeholders</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidemiological measures (risk factors, odds ratios for disease)</td>
<td>7</td>
<td>24</td>
</tr>
<tr>
<td>Measures of pathogens</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Morbidity/mortality measures</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Other (no commonalities among outcomes)</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Participants' perception relating to the problem - qualitative description</td>
<td>18</td>
<td>62</td>
</tr>
<tr>
<td>Participants' perceptions relating to the problem - quantified</td>
<td>9</td>
<td>31</td>
</tr>
<tr>
<td>Physical, chemical or biological measurements of participant</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Physical, chemical or biological measurements of the environment</td>
<td>10</td>
<td>34</td>
</tr>
<tr>
<td>Self-reported health</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Not reported</td>
<td>16</td>
<td>55</td>
</tr>
<tr>
<td>Workshop/meeting</td>
<td>13</td>
<td>45</td>
</tr>
</tbody>
</table>

1 Categories in many cases were not mutually exclusive.

2 For the purpose of categorization, “mapping” is a general term used here that could refer to formal or informal methods including Geographical Information Systems, social network analysis, satellite imaging techniques, drawing diagrams to show who/what is involved in the problem and aspects of participant communities.

3 Methods/tools that did not fall under the other categories but didn't have any similarities that could be their own groups: Multi-Criteria Decision Analysis, educational models
PRA include: farmer field schools, learning contracts, role reversals, feedback sessions, transect walks, wealth ranking, social mapping, focus group discussions, semi-structured interviews, triangulation, Venn diagrams, matrix scoring, and timelines. Note: many participatory action research (PAR) techniques fall under these groups including narratives. Methods/tools were only classified under PRA if the study explicitly reported using PRA or PAR. Source: Mukherjee, A & Chambers, Robert. (2004). Participatory Rural Appraisal: Methods & Applications in Rural Planning, Second Edition. New Delhi, Vikas Publishing House.
Search Strategy Implementation
7543 de-duplicated hits

Relevance Screening One
596/7543 abstracts potentially relevant
587 located, 9 could not be found but deemed irrelevant

Relevance Screening Two
174/587 articles relevant

Commentaries
47/91 elaborating on description of ecohealth/ all commentaries

Analysis Method Framework
24 commentaries analyzed and saturation of concepts reached

Primary Research
29 explicitly stating they used the approach and were in the context of public health

Data Extraction
29 primary research papers Descriptive Analysis
Figure 2.1  Numbers of abstracts and full papers evaluated at various stages of the scoping review of ecohealth
Figure 2.2  Mind map showing the categories, themes, and interconnections between concepts in ecohealth
CHAPTER THREE

CASE STUDY OF HEALTH AND ENVIRONMENTAL SANITATION IN HANAM, VIETNAM: IDENTIFYING THE ENABLERS AND IMPEDIMENTS OF ECOHEALTH

ABSTRACT

Research to-date has shown an increasing use of the term “ecohealth” in the literature, but many researchers that claimed to use an ecohealth approach did not explicitly describe how it was used. We investigated a project of health and environmental sanitation in Hanam, Vietnam, whose conceptual framework included the pillars of ecohealth, in order to identify impediments and enablers of ecohealth and investigate theory-to-practice. A case study approach was used, along with key informant interviews and focus groups involving researchers, members of local institutions, and community participants, as the tools for data collection; questions used related to the nature of interactions and sharing of information between stakeholders. Ecohealth enablers, impediments, and other themes that were identified pointed to the need to address issues of sustainability of research efforts and communication among stakeholders and revealed that research that only uses disciplinary methods limits participation. Our research emphasized the importance of negotiating indicators for success of the research, within a participatory approach, since they may differ among different stakeholder groups. Furthermore, ecohealth practice involves collection of data from multiple

1This manuscript was formatted according to the guidelines from the EcoHealth Journal.
scales and sectors. The challenge of how to integrate these must be considered at the design stage and throughout the research. We recommend that ecohealth research teams include a self-investigation of their process in order to facilitate a comparison of theory-to-practice. This may serve as a best practice for ecohealth research and may also offer insights into how to evaluate the process.

Keywords: ecohealth, evaluation, health, environmental sanitation, South East Asia, case study

INTRODUCTION

Through the Swiss National Centre for Competence in Research North-South Program (NCCR), the Swiss Tropical and Public Health Institute (Swiss TPH) developed a conceptual framework for environmental sanitation assessment for the improvement of both human health and environmental sustainability (Nguyen-Viet et al., 2009). Their project in Vietnam aimed to address the risk that human waste and reuse of wastewater poses for agriculture, environmental sanitation, and human health. This conceptual framework incorporated the pillars of ecohealth, as defined by the Community of Practice in Ecosystem Approaches to Health-Canada (CoPEH-Can); sustainability, participation, equity, and transdisciplinarity (CoPEH Canada, 2010).

Recently, there has been increasing use of the term ecohealth in the literature, but many researchers that claim to use an ecohealth approach do not
explicitly describe how they apply this approach (Chapter 2). Moreover, few publications have reported if ecohealth pillars were applicable or utilized in their work, making it difficult to review the utility of ecohealth in practice.

Monitoring and evaluation of the process of ecohealth research and of outcomes are important components of the ecohealth approach (IDRC, 2005). There has been, however, relatively little published research on evaluation of ecohealth projects, including in-progress evaluation to determine their consistency with ecohealth concepts (Sherwood, Cole, & Crissman, 2007). Boischio et al. (2009) discussed challenges and opportunities of ecosystem approaches in prevention and control of dengue and Chagas disease. However, this was a discussion of their experience with the Canadian International Development Research Centre’s (IDRC) Ecohealth Program Initiative rather than a project evaluation per se. The IDRC has emphasized outcome mapping for ecohealth evaluation; however, it is difficult to apply to projects in-progress, where there has usually been inadequate time to achieve project outcomes (IDRC Evaluation Unit, 2005; IDRC, 2005). Thus, a case study involving a mid-term examination of the processes used in an ecohealth project may provide some useful insights for understanding the concept and practice. The case study approach is a well-recognized methodology in qualitative research and is useful for in-depth investigation of an issue (Creswell, 2007).

The specific challenges and opportunities for implementing ecohealth in practice may be different for each cultural context, specific community, and national infrastructure. However, the issues encountered when trying to work
across disciplines, using participatory approaches, ensuring equity in the process, and building capacity for sustainability of interventions may apply more generally across ecohealth projects. In addition, our recent scoping review of the peer-reviewed literature on ecohealth in the context of public health revealed that the practical aspects of applying ecohealth concepts in practice have received relatively little attention (Chapter 2).

The central research questions in this study were: What were the impediments and enablers of ecohealth in practice for a project on health and environmental sanitation in Hanam, Vietnam; and how well did the research process fit with the general concepts of ecohealth? Sub-questions included: What was the nature of interactions among stakeholders and how was knowledge shared throughout the research process? What themes emerged from analysis that were consistent with ecohealth themes in the literature and which themes were unique to this case? Our objective was to investigate ecohealth “concept-to-practice”, which we accomplished by assessing the project’s conformity to and consistency with components of ecohealth (i.e. the process, not the data or outcomes specifically) with concepts we found in the literature from our scoping review (Chapter 2).

MATERIALS AND METHODS

Study Approach

This research followed a case study structure, in which the case was identified and the boundaries, sources of information for data collection, and the context were described (Creswell, 2007). Some of these features are expanded
upon in the results section of this paper because they were part of the outcomes of this case study. A “bottom-up” approach was taken by examining the nature of interactions among stakeholders and how information was exchanged and shared through the research process; questions for the participants were constructed accordingly. We defined a stakeholder as a person or group of people that was not only affected by the issue of environmental sanitation in the project site, but was also involved in the research process. For our purposes, the researchers were also considered stakeholders. Involvement was defined as one or more of participation in problem definition, establishing partnerships/collaborations, research planning, execution, analysis, and results sharing.

**Study Design**

*Identification of the system under study*

The system under study was confined to the research project of the NCCR research team in Vietnam and the stakeholders involved in their research. All case study data were collected by the first author (VN) during study site visits in Vietnam. Initially, sources of information included some project documents in English and meetings with the NCCR research team, led on-site by a post-doctoral researcher employed by the Swiss TPH. The project’s graduate student researchers were identified when the case study began in Vietnam.

*Entry into project site*

The case study data were collected between January and May 2010. Ethics approval for research involving human participants was obtained from the
Research Ethics Board of the University of Guelph (REB# 10JA017) and the Hanoi School of Public Health (HSPH) (Decision No. 645/QD-YTCC); the latter institution hosted the research in Vietnam. Permission/introduction letters were obtained to gain access into the two study sites (communes). Before starting data collection, four field visits with the NCCR team were conducted during their sampling and survey collection periods and during presentations of project research results to some project stakeholders. These visits were intended to establish contact and rapport with potential participants and to meet community members (CMs) and local authorities. In particular, the visits included introductions to the Chairman or Vice Chairman of the Communal People’s Committee (CPC) (who represented the local government), the Head of Health Station (HHS), and leaders or members of the Women’s Union (WU). In addition, VN attended a community event in both communes on International Women’s Day, March 8, 2010, hosted by the WU.

Selection and recruitment of participants

Case study participants were selected through snowball/chain sampling; a way of finding key informants through a network of acquaintances (Patton, 2002). The case study data that were collected were limited to the perspectives of the researchers, local institutions, and CMs involved in the project. The identities of stakeholders were determined through a meeting with the project lead, while their general roles in the project were described by the graduate student investigators, who were also participants in our case study because they were directly involved in nearly all aspects of the project. The HHS, some of the health station workers
(HSW), and village health workers (VHW) for both communes were included as participants because they collected project data in their communities when the project researchers were not present. They provided population health information and facilitated and conducted interviews with residents in the communes. CMs who participated in our case study were selected from a list of all project participants by the HSWs. The CMs were included because they were the intended beneficiaries of the project research, and we wanted to draw out their opinions directly, instead of relying on secondary sources. Female CMs were purposively selected for the case study because the women were primarily responsible for the health of their families, sanitation and agricultural work in their villages. To capture a diversity of perspectives, case study participants were selected from different villages by convenience sampling, depending on availability of participants. The NCCR team and the HHS were contacted by telephone; the other participants were contacted through the HHS, who organized the schedule and venue for the interviews and focus groups.

Data collection

Questions were developed to solicit information on the nature of interactions among project stakeholders and how knowledge was shared throughout the research process. Core questions were used with all stakeholder groups and these were supplemented by stakeholder-specific questions. The questions were reviewed for clarity and appropriateness to local context by the NCCR project lead who had experience with health research at the commune level in Vietnam. Formal pre-testing of the questions was not done given the
limited number of participants available for the key informant interviews; however, a focus group pre-test was conducted with CMs in Hoang Tay Commune in May of 2010. The interview and focus group questions are listed in Appendices 3.1-3.6.

Four sets of questions were used for the 1) project lead, 2) graduate student researchers, 3) HHSs and HSWs, 4) VHWs, and CMs. Table 3.1 lists the data collection methods, language, and purpose of questions by stakeholder group. The questions were open-ended and were supplemented with additional pre-determined probing questions to gather more detail if initial responses were very short or too general. In addition, some ad hoc probing questions were asked during the interviews and focus groups for the same purpose.

Key informant interviews were conducted individually with the NCCR team members, HHSs and HSWs, and focus group discussions were held with the CMs and VHWs (both groups of stakeholders and both communes were handled separately). Eight participants were invited to each focus group. All interviews and focus groups were designed to last between 1 to 1.5 hours. The interviews with the research stakeholders were conducted at the HSPH and National Institute of Hygiene and Epidemiology in Hanoi, while the rest where conducted at the Health Stations in Nhat Tan and Hoang Tay Communes, Kim Bang District, Hanam Province. CM participants of the interviews and focus groups were each offered an honorarium of 50,000 VND.
Translation and transcription

The questions for both interviews and focus groups were initially drafted in English then translated into Vietnamese. Most of the interviews were conducted in Vietnamese by the Vietnamese translator; those in English were conducted by VN. Interviews were recorded digitally and responses were translated and transcribed directly into English by the Vietnamese translator, then checked by VN during coding (analysis), by correcting errors in the transcripts when listening to the recordings.

Data Analysis

The interview and focus group responses were analyzed using a modification of the analysis method framework; the first step was adapted to provide guidance on coding themes and writing memos (Table 3.2, Appendix 3.7) (Spencer, Ritchie, & O'Connor, 2003). This first step of data analysis was part of an iterative cycle with data collection. After each interview, this step was used to identify initial themes using the interview recordings directly rather than waiting for the translation and transcription. When appropriate, some questions were added to further explore a finding in the subsequent interview. After data collection was completed and all responses were translated and transcribed, the remainder of the steps of the analysis method framework were implemented for all transcripts. The analysis was performed and managed using qualitative data analysis software, ATLAS.ti 6.1. (ATLAS.ti GmbH, Berlin, Germany).
RESULTS

Description of the case and context

The NCCR Program was one of twenty initiated in 2001 by the Swiss National Science Foundation for sustainable development (NCCR North-South, 2009). The purpose of this 12 year program was to build research capacity in partnership in each of 9 regions of Asia, Africa, Latin America, and Switzerland, while establishing a formal institutional network amid these northern and southern countries. Phase 1 (2001-2005) concentrated on disciplinary and interdisciplinary research addressing 30 issues central to globalization, defined together by northern and southern partners, for example, access and availability of freshwater and limited health services. Phase 2 focused research activities on 4 areas: governance and conflict, livelihoods and globalization, health and environmental sanitation, and natural resources in sustainable development (NCCR North-South, 2009).

This case study focused primarily on phase 2 of the research, in particular, the health and environmental sanitation theme or project. The conceptual framework developed by the Swiss TPH and partners in the North and South (Figure 3.1) was tested in Southeast Asia and West Africa as examples, and the subject project of our case study focused on the research activities in Vietnam (Nguyen-Viet et al., 2009), which aimed to assess the risk that the reuse of human excreta and wastewater in agriculture and aquaculture poses to environment and health (the problem).
Their project was conducted in a peri-urban area, approximately 60 km south of Hanoi, Vietnam, in Hanam Province, Kim Bang district, Nhat Tan and Hoang Tay Communes. These two communes were typical Vietnamese communes, with poor services for sanitation, wastewater drainage, and solid waste management (Do Thu, 2009) (Figure 3.2). The major land uses in the study sites were residential, agriculture (rice cultivation), and aquaculture. Agriculture was considered the main source of livelihood.

Figure 3.3 displays a broad overview of environmental, social, economic, and health aspects of the problem, which were identified through the project’s research, the details of which were extracted from project documents. The project stakeholders are shown in Figure 3.4. The project involved four graduate students working on individual components or sub-projects, which were undertaken within the same study sites. The general study details of each student’s research are displayed in Table 3.3.

**Interviews and focus groups**

Individual interviews were conducted with one project lead, two graduate students, two HHSs, and three HSWs. There were eight and five participants in the two focus group with CMs, and six and three VHW participants in Nhat Tan and Hoang Tay, respectively. Personal identifiers (e.g. names, age, and village number) were kept confidential.

The analysis of the interviews and focus groups led to the identification of 105 themes. Table 3.4 lists the themes with groundedness of 20 or greater, of
Groundedness refers to the number of occurrences of a particular theme and gives an indication of the relative importance given to a theme by participants. A cut-off of 20 was chosen to make analysis more manageable within our time constraints. Groundedness of the 18 themes ranged from 21 to 117; of the remaining 87, it ranged from 1 to 16 (83% of the 87 were below five). The 18 themes were sorted into 5 categories, based on commonalities among themes. The themes, their explanations, and some exemplary quotations are displayed in Table 3.4; the former were grouped together with other themes based on commonalities among themes.

The 23 themes presented in Table 3.5 related to the nature of interactions and sharing of information among stakeholders. We used the category “impediments and enablers of ecohealth” because it addressed an objective in our case study, although it also included a few themes that were included in the 18 themes mentioned previously. Those in Table 3.6 related to community-identified ideal solutions, community roles, and signs of improvement in health and environmental sanitation.

We assessed the project’s conformity to and consistency with the ecohealth concepts and components (themes) of ecohealth that were identified in Chapter 2. Table 3.7 shows the components we used, their explanations, project details that pertain to each component, and the source of information used to extract these details. If our assessment was treated like a checklist, then the project could be consistent with most of the themes of ecohealth. However, if the
component explanations are taken into account, then the project would not be considered consistent with most themes.

**DISCUSSION**

Overall, examining the factors that helped or hindered the research team in reaching an ecohealth process during the first 3 years of the project gave important insights into how one might implement ecohealth in practice. It is important to note that the project was still in progress at the time of this study, therefore our findings are not necessarily reflective of the entire project. While the case study project faced several challenges in implementing a number of ecohealth concepts, the conceptual framework of the project’s research corresponded quite strongly to ecohealth. This was evident in the design and preliminary documents, where concepts of integration, multi-stakeholder participation, and an understanding of the system were stressed. The main challenges were related to fully realizing a transdisciplinary and participative approach and to sustaining the research efforts. However, we believe that it is valid to apply the lessons from this case study to ecohealth research in general because it highlights the challenges and discrepancies between theory-to-practice that would likely be discovered if most of the self-classified ecohealth projects in the published literature explained their ecohealth approach. It is important to note that there is currently no consensus on ecohealth concepts among fields that have the similar initiatives of working towards more holistic, integrated approaches and application of these concepts is often context-
specific. Therefore, the approach is not intuitive and requires an explanation. In order for ecohealth to develop, conceptually and practically, in a more rigorous way, future work should concentrate on reporting and evaluation of process.

Communication between stakeholders was a major overarching theme that emerged from our analysis; not the lack of communication, but rather the language or terminology used (both English vs. Vietnamese and technical vs. lay), the mode of disseminating information, differing perceptions of the problem and roles and responsibilities of stakeholders in that problem, and a social environment conducive to effective communication. To address these challenges of the human aspects of ecohealth, we suggest that a shared glossary, or alternatively, diagrammatic techniques would help facilitate the process. This could facilitate a shared understanding of the problem, more meaningful participation and collaboration, a mechanism for engaging stakeholders, and ultimately affect the sustainability of research efforts. Despite some of these limitations, the theme “interaction” showed this had increased between stakeholders as a direct result of the project, which would not have otherwise happened. This shows a change that could potentially have effects beyond the intended research efforts. In order to demonstrate this change, one could perhaps use social network analysis, like Mertens et al. (2005) in their study on equity in participation through analysis of a community’s discussion network about mercury and health to capture involvement of participants.

We used our synthesized interpretation of ecohealth, which was informed by a scoping review of the literature on ecohealth in the context of public health
(Chapter 2) to assess the case study project’s consistency with ecohealth concepts. Our synthesized interpretation was strongly influenced by the IDRC’s position on ecohealth, because most of the published research identified in the scoping review were supported by this funder or they cited use of IDRC’s approach to ecohealth (Chapter 2). There are other fields of study that also use holistic and integrated approaches to addressing health and environmental issues. These include, but are not limited to, "one health” initiatives, global health research, conservation medicine, and ecosystem management (Brown, Mackensen, & Rosendo, 2005; PHAC, 2009; Stephen & Daibes, 2010; Tabor, 2002). Thus, evaluation of ecohealth is complicated by the lack of consensus on the ecohealth concept and the fact that it informs a process which is often context-specific. As a result, understanding of ecohealth and implementation is varied; this particular finding was also cited by authors of an external review of the IDRC’s Ecohealth Program (Finkelman, MacPherson, Silbergeld, & Zinstaag, 2008). It is also important to note that these components of ecohealth should not be treated as a checklist for inclusion in order to qualify a study as ecohealth, nor does it mean that practical application will always correspond with theory. An explanation of the process as it was implemented is required, to give readers the ability to evaluate the validity of one’s statement.

Our study has limited generalizability because the findings were specific to the case. Our intention was to gain a richer understanding of ecohealth in practice, which was difficult to investigate from simply reading published
literature, the majority of which has to-date not comprehensively documented the process (Chapter 2).

We extracted information on the environmental, social, economic, and health aspects of the problem of health and environmental sanitation being studied in the project, which helped to understand the system under study and its parts. We found that aspects of the problem were not confined to a particular scale and sector but were interconnected and spanned multiple scales (local, regional, or national) and sectors (health, social, economic, and environment). This complexity is typical of most public health problems in other countries (Neudoerffer, 2005), if their multidimensional natures are adequately taken into account. This has also been highlighted in other ecohealth publications. Marko et al. (2004) developed and applied a framework for analyzing the impacts of urban transportation in Edmonton, Canada and illustrated the economic, socio-cultural, infrastructural, and political factors that affected transportation, and the economic, socio-cultural, environmental, and health impacts that were affected by transportation (Marko, Soskolne, Church, Francescutti, & Anielski, 2004).

Murray and Sanchez-Choy (2001) conducted research to improve the health of rural Amazonian communities, and found that in order to make connections between ecosystem variables, resources use, and health, it was necessary to analyze the issues at different scales; they collected data at the landscape, community, and household levels (Murray & Sanchez-Choy, 2001). This suggests that for complex problems that span multiple scales and/or sectors, research should involve the collection of data from those scales and sectors.
influencing the issue under study. A starting point for research could be to illuminate and report which scales and sectors are appropriate to examine, which would require both scientific and local knowledge, and consider whether the complexity of the issue under study is adequately captured by the original research question(s).

The case study showed that the integration aspect of transdisciplinarity was difficult to achieve. In their project, the NCCR researchers collected data from different sectors, but the challenge for them, and sometimes for ecohealth research in general, was how to integrate these data (Charron, D. in press). We believe that integration must be planned and part of the research process, in order to be feasible. Charron cited the same challenge for ecohealth in an examination of many case studies funded by IDRC’s Ecohealth Program and echoed this view of planned integration (Charron, D. in press). This suggests the need for new tools and group processes to achieve integration, since this requires multiple disciplines and types of stakeholders. Despite these challenges, the collection of data from different sectors highlighted the multi-dimensional nature of the issue of environmental sanitation.

Our stakeholder map (Figure 3.4) shows that the problem of health and environmental sanitation affects, and thus requires participation from, a wide range of stakeholders. The map identifies involved groups but does not explain the mode or extent of participation. However, this figure could serve as an ecohealth output of the NCCR team’s research; it displays the network formed as a result of the research process. One of themes we identified and categorized as
an enabler of ecohealth in our case study was “networks”. Mertens et al. (2005) investigated equity in participation among villagers in the Brazilian Amazon and described the following modes of participation for different phases of their research (from Biggs (1989): “1) contractual, where members of the local communities were contracted in the projects of the researchers to take part in the experiments with no decision power; 2) consultative, where local people were asked for their opinions as input for research and actions which were under the control of the researchers; 3) collaborative, where CMs worked together with researchers to determine priorities but responsibility remained with researchers for directing the process; and 4) collegiate, where the local people and researchers shared their knowledge to create new understandings and work together to form action plans under the control of the local people” (Biggs, 1989; Mertens, Saint-Charles, Mergler, Passos, & Lucotte, 2005). In this case study project, the mode of participation could be categorized as consultative.

Recommendations for the next phase of research, if ecohealth is the desired approach, include striving for more collaborative and collegial participation by negotiating research priorities together during planning phases and sharing research progress and results more regularly so that CMs can take part in the planning of results dissemination that is appropriate and effective in their own communities. It should be noted that during interviews and focus groups, various stakeholders indicated that reading results over loudspeakers in the community was not an effective way to reach a wide range of CMs and they felt that education and awareness about the issue of environmental sanitation was a
start, but not enough to address behavioural change and improvements in the situation. Perhaps the above descriptions of modes of participation could be used in reporting of ecohealth research.

The theme “don’t understand” (categorized as an impediment of ecohealth) may reflect that affected stakeholders were not equally engaged or involved. At the community level, reduced involvement may affect their capacity to understand, retain, learn from, and use the results of the research. The theme “don’t understand” may also highlight that the use of disciplinary methods (epidemiological surveys, for example) “limits participation” (another theme) from most stakeholders to simply helping the researchers collect their data and providing information for them to conduct the research. This type of participation is helpful for researchers because it allows them to obtain data for their research, but it is particularly extractive for CMs, in the sense that they provide data for researchers but their desired outcomes and expectations are not met in the short term, which could result in “research fatigue”. To address these issues, researchers could include participatory methods into the research process that are not specific to a particular discipline, sector, or education level when attempting to engage a wide variety of stakeholders. These include creating rich picture maps (Bunch, 2003) or issue and influence diagrams ((Neudoerffer et al., 2005)) with CMs. A variety of participatory methods are available, many classified under participatory action research. The point is not that participation is contained within a checklist for doing ecohealth, since “participation” can mean
many different things to different people, but to involve stakeholders by going beyond traditional extractive approaches.

The two overarching themes that could describe the identified enablers and impediments of ecohealth are sustainability of research efforts and communication among stakeholders. All of the themes categorized under “impediments and enablers of ecohealth” in this case study were likely not context-specific. For example, several of these themes were similar to the factors discussed by Boischio et al. as challenges and opportunities of ecosystem approaches in prevention and control of dengue and Chagas disease based on their experience with ecohealth projects through the IDRC Ecohealth Program Initiative (Boischio et al., 2009). Some of the themes we identified, however, were different from their explicitly discussed factors, including: financial contributions from collaborators, the need to test and monitor the situation, lack of acceptance of new approaches, differing education levels and professional backgrounds impeding communication among some stakeholders, lack of terminology to express ecohealth concepts in the target language, and lack of clarity on how to integrate research components. These are issues that cut across cultures, sectors, and disciplines, and are not necessarily unique to ecohealth research. While these issues are not simple to address, they could be considered in the design phase of research and used in monitoring its progress and process.

The gains from the NCCR research project also highlighted the sustainability of research efforts, namely awareness and understanding, capacity
development at the institutional level, and increased interactions among stakeholders, which were captured as important themes in our research. These areas are often not captured as traditional research outcomes especially if publications focus only on technical aspects of the research. Capturing them may require additional research activities not part of the original research scope, and thus requires more funding and time to accomplish, or alternatively, they may not be objectively measurable. In addition, these gains are often exclusive to the direct participants and collaborators of the research. Two strategies are suggested for adoption during the research process in order to address these issues. First, outcome mapping, an evaluation tool promoted and used by IDRC for programs, projects, and organizations, could be used to demonstrate these gains from the research and as a way of monitoring progress. There are a variety of resources on outcome mapping available on IDRC’s website (IDRC, 2010) and an Outcomes Mapping online community (Anonymous, no date). The second is to consider using knowledge translation tools throughout the research process that will enable the community to use and disseminate the results and progress of research to ensure wider spread uptake and scaling up of the research outcomes. Presenting the research results to the CMs moves in the right direction, but may be insufficient for sustainability of the research efforts after the project ends.

The “responsibility” category of themes highlights the negotiation component of ecohealth. Various participants from different stakeholder groups, including the researchers themselves, perceived that the responsibility of
implementing interventions was not theirs, but belonged to another group. They all indicated that they did not have the appropriate knowledge, authority, or resources to design, implement, and monitor interventions. However, they also acknowledged that this responsibility, along with the research data and results, should be shared among the different groups. This may be indicative of a willingness to cooperate together on interventions and a sense of local ownership, upon which the researchers can capitalize when moving towards the intervention phase of the research.

Negotiation, as a component of ecohealth, is also inclusive of negotiating indicators of success of the research. The input from CMs on solutions, roles, and signs of improvement, with respect to the problem of sanitation, shows that their participation in interventions requires the involvement of multiple sectors and a holistic view of health. This is because the issue spanned not only the health sector, but also the environmental, social, and economic aspects of the issue, since they were clearly interrelated. This broader view on health was evident since the signs of improvement encompassed many determinants of health that lie outside of the health sector, such as economic status and the physical environment (World Health Organization, 2011). Public health professionals have traditionally viewed improvements in health in terms of morbidity or mortality indicators, for example, reduction of diarrheal diseases. On the other hand, communities may not be as concerned with these indicators, but rather are interested in cleaner roads and improved economic status, as identified in our case study. Therefore, indicators of improvements in the problem
under study need to be negotiated in ecohealth research, as found in our scoping review (Chapter 2). The researchers alone may not be able to address the full spectrum of indicators related to environmental and social determinants of health and some of the CM’s ideas, such as burning garbage, may have negative consequences for the environment or human health. However, this underscored the importance of engagement and capacity development at the community level with local institutions and CMs that are not part of these institutions. This could be accomplished with tools like the joint creation with CMs of rich picture maps (Bunch, 2003) and issue and influence diagrams (Neudoerffer et al., 2005), but can extend to a variety of other participatory methods. These represent two ways of overcoming the issue of working across sectors, disciplines, and even education level.

CONCLUSION

Our case study offered insights into the operational challenges that occur when attempting to implement the ecohealth approach, which is a novel contribution to the published literature. In future, ecohealth research teams should include a self-investigation of process in order to facilitate a comparison of theory-to-practice. This may serve as a best practice that is part the ecohealth process. Additionally, it may also offer insights into how to evaluate ecohealth research, which is difficult if authors do not explain their approach and how implementation corresponds with concepts. Further work stemming from these
lessons and insights for study design would greatly contribute to the development of the field of ecohealth.

ACKNOWLEDGEMENTS

The authors would like to thank the NCCR research team for their support ranging from supervision, guidance, facilitating the research partnerships, obtaining research approval, to help with fieldwork activities, translation, and transcription: Hung Nguyen Viet, Phuc Pham Duc, Jakob Zinstagg, Tu Van Vu, Khuong Nguyen Cong, Nga Thu Do, and Nhung Hong Nguyen; the CoPEH-Can for funding this research; Hanoi School of Public Health (Department of Environmental Health) and National Institute for Hygiene and Epidemiology in Vietnam, and Swiss Tropical and Public Health Institute in Switzerland for their in-kind contributions to this research; the research participants from the community and local institutions in the study sites for their insights into the research process, and the Public Health Agency of Canada for supporting this MSc thesis.
REFERENCES


Table 3.1: Case study data collection methods, language of delivery and purpose of questions, by stakeholder group

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Category</th>
<th>Project lead</th>
<th>Graduate student researchers</th>
<th>HHS &amp; HSWs</th>
<th>VHWs &amp; CMs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data collection method</td>
<td>Key informant interview</td>
<td>Key informant interviews</td>
<td>Key informant interviews</td>
<td>Focus groups</td>
</tr>
<tr>
<td></td>
<td>Language</td>
<td>English</td>
<td>All Vietnamese except Part 1 with PhD student</td>
<td>Vietnamese</td>
<td>Vietnamese</td>
</tr>
<tr>
<td></td>
<td>Purpose of Questions (no. of questions, no. probes for this question)</td>
<td>Stakeholder role (1, 3)</td>
<td>Stakeholder role (1, 3)</td>
<td>Respondent information (2, 0) - 3 for HSWs</td>
<td>Involvement in this research (1, 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Understanding research problem (1, 5)</td>
<td>Interaction between NCCR team (1, 6)</td>
<td>Participation in the research (11, 0)</td>
<td>Thoughts on research topic (1, 14)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Establishing collaborations (2, 8)</td>
<td>Research objectives (2, 4)</td>
<td>Results sharing (4, 0)</td>
<td>Researchers’ approach with VHWs &amp; CMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Research planning (2, 0)</td>
<td>Sharing of information (3, 5)</td>
<td>Using research results (6, 0)</td>
<td>Issues important to CMs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conducting research (2, 1)</td>
<td>Understanding research problem (2, 4)</td>
<td></td>
<td>Learning from participation (1, 4)</td>
</tr>
<tr>
<td>Analyzing/interpreting results (1, 0)</td>
<td>Successes &amp; challenges (2, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results sharing (4, 0)</td>
<td>Contribution to CMs⁴ (1, 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beneficiaries of the research (3, 0)</td>
<td>Beneficiaries of the research (3, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research objectives (1, 0)</td>
<td>Research approach (9, 0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Research approach (15, 6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹HHS – Head of health station; ²HSW – health station worker; ³VHW – village health worker; ⁴CM – community member; ⁵NCCR – National Centre for Competence in Research North-South
<table>
<thead>
<tr>
<th>Step</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Identifying initial themes by reading the document, writing memos about the data, and creating a coding list with definitions</td>
</tr>
<tr>
<td>2</td>
<td>Labelling or tagging data by theme by applying the coding list to other documents and iteratively making revisions to the coding list for new themes that emerge</td>
</tr>
<tr>
<td>3</td>
<td>Sorting data by theme, each in a separate matrix that allows the reader to clearly see the data and the document from which it came</td>
</tr>
<tr>
<td>4</td>
<td>Summarizing and synthesizing data in another similar matrix that only captures the content and context</td>
</tr>
<tr>
<td>5</td>
<td>Identifying elements and dimensions, refining categories, classifying data in another matrix by reading the matrices from the previous steps and labelling the data to suggest what it represents</td>
</tr>
<tr>
<td>6</td>
<td>Detecting patterns by searching within and then across documents for linkages and repetition</td>
</tr>
<tr>
<td>7</td>
<td>Developing explanations by giving reasons that relate to the patterns found in the previous step</td>
</tr>
</tbody>
</table>

1 Adapted from (Spencer, Ritchie, & O'Connor, 2003)
Table 3.3 Description of major elements of graduate student sub-projects within the health, social, and environmental research components of the National Centre for Competance in Research North-South (NCCR) project

<table>
<thead>
<tr>
<th>Category</th>
<th>NCCR Research Project Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree (number of students), discipline</td>
<td>Health</td>
</tr>
<tr>
<td>PhD (1), Epidemiology</td>
<td>MPH (1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Health</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health risks of ww &amp; excreta reuse in agriculture &amp; aquaculture in northern Vietnam</td>
<td></td>
<td></td>
<td>Assessing nutrient flows by MFA in Hanam Vietnam</td>
</tr>
<tr>
<td>QMRA² of exposure to ww &amp; excreta in agriculture in Hanam, Vietnam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessment of human behaviours of reusing ww &amp; excreta in agriculture based on PMT³ Framework</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective(s)</th>
<th>Health</th>
<th>Social</th>
<th>Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine prevalence of infections of helminths, E. histolytica, C. parvum, G. lamblia, &amp; Cyclospora, incidence &amp; risk factors of diarrheal disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess exposure to ww &amp; excreta in agriculture &amp; determine risk of infection by C. parvum, G. lamblia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Examine perception &amp; behaviour related to use of ww &amp; excreta (health risk, coping appraisal, intention to act) based on PMT, develop a questionnaire to assess this, validate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantify nutrient (N⁵ &amp; P⁶) flows in an agricultural &amp; environmental sanitation system, develop scenarios to reduce the N or P discharge into the environment at all critical control points</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------</td>
<td>-----------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>Methodologies</td>
<td>Epidemiology</td>
<td>QMRA</td>
<td>PMT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MFA</td>
</tr>
<tr>
<td>Data sources &amp; collection methods</td>
<td>Household surveys</td>
<td>ww sampling</td>
<td>Qualitative: in-depth interview, focus group discussions with farmers, field observation</td>
</tr>
</tbody>
</table>

\[1\] ww: wastewater; \[2\] QMRA: Quantitative Microbial Risk Assessment; \[3\] PMT: Protection Motivation Theory; \[4\] MFA: Material Flow Analysis; \[5\] N: nitrogen; \[6\] P: phosphorous
Table 3.4  Identified themes with groundedness 20 or greater from application of the analysis method framework to transcripts of interviews and focus groups with different stakeholder groups.

<table>
<thead>
<tr>
<th>Category</th>
<th>Theme</th>
<th>Explanation</th>
<th>Selected quotations (transcript number, line(s) in transcript)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibility</td>
<td>advocate</td>
<td>CMs$^1$ &amp; VHWs$^2$ identified that advocating about general hygiene is a role of the CMs to improve ES$^3$</td>
<td>&quot;Firstly, we need to mobilize the people so that they can understand the harm of a polluted environment and advantages of clean environment...so there will be co-operation between us and the local government.&quot;</td>
</tr>
<tr>
<td></td>
<td>intervention - &quot;their&quot; job</td>
<td>Interventions are the responsibility of another group (because they have the appropriate knowledge, authority, or resources)</td>
<td>&quot;The HS$^4$ is in charge of advocacy, checking health status and giving treatment. This [ES] is mainly up to the government and other relevant departments such as the WU$^5$, Youth Union, Farmers Union, etc. &quot;</td>
</tr>
<tr>
<td></td>
<td>sharing process</td>
<td>The responsibility for interventions, the data, and results should be shared by stakeholders; each person has a part</td>
<td>&quot;Because when all unions and department cooperate, they can advocate widely to people, the people can follow, and keep good sanitation. It can't work if just one does it. They can't go to each person.&quot;</td>
</tr>
<tr>
<td>Gains from the research</td>
<td>awareness &amp; understanding</td>
<td>CMs &amp; local institutions have increased knowledge or deeper understanding of the issues of HES$^6$ from participation in the research and from the results</td>
<td>&quot;About waste things in the Nhue River, we do know about it but we don't know the percentage of infection, whether it is too much, without the results...from the last presentation [on MFA$^7$].&quot;</td>
</tr>
</tbody>
</table>
capacity development

Development of knowledge and skills of involved stakeholders so they can contribute to their own organizations

"NCCR focuses on partnership with Vietnam’s Institutes...through the projects co-operating with foreign countries, they improve research capacity [of researchers & supporters]...learn new methods & knowledge. NCCR wants them to be active in research so don't need to wait for any support from outside."

interaction

Interactions have increased as a result of the project (more regular contact between VHW with CM and "upper levels" like the HS) NCCR team work on a common base with different aspects of the issue under study

"More contact with them [HSW's] every time we go [to study site], less with CM participants because there are a lot of people, we can’t meet a lot, HSWs have much more contact with CM, keep a good relationship. Researchers can’t cover everything."

"Same study site, program, general of objectives, share information [general information about commune, agricultural activities, main water source, kind of water used for rice field]. Develop protocol, methods, tools for collecting data (assessment for QMRA), questionnaire, design sample collection [environmental], how many, where. We conduct field visit together to understand people's exposure, pre-test questionnaire, interview people."
Community opinions & priorities

CM's priorities could be categorized under health, environment, social, and economic issues

Health: “skin problems like itching or eczema”
“invest something for the commune, relates to health care, like ultrasound machine”
“They [women] spray it [pesticides] on crops, without using goggles or masks. They faint, spray too much, get dizziness or headache.”

Environmental: “In the future [researchers] can provide us something, for ex., related to sanitation”

Social: “Two important things aside from environment: livelihoods & children’s education. People have invested a lot in these for 2 years, rate of people passing university entrance exam high compared with provincial standard”.
“Sometimes they keep our children over night in the [internet cafe] shops. The children don’t come back home that night.”
“Now it’s a problem of power [outages].”

Economic: “They can only spend a little time coming here [to participate in research], very difficult to invite those who have to work more at home, to earn extra money.”

“Our commune is big with 11000 people. We live close to each other... too much waste from people. On the street, there are many piles of garbage/waste. Commune mobilized people many times [WU, other sectors] to participate in ES, but it's not enough.”

nowhere for waste & wastewater

CMs expressed that there is no place for disposal of these things
<p>| wastewater &amp; excreta harm human health &amp; environment | &quot;If it's not clean [ES], people can't be healthy, it will affect everything... economy. If environment is clean, we will be healthy and will be capable of doing anything.&quot; |
| diseases &amp; conditions | &quot;Headache, diarrheal diseases, fever, respiratory diseases, cancer, runny nose, coughing, death, sore throat, skin diseases, sore eyes.&quot; |
| local knowledge | &quot;We want our people to sit together and we can advocate to each other. When we meet leaders, we don’t have any power to have a meeting with them, can’t argue or give them advice. They don’t work directly with the people. We want to do that but we can’t go in [to participate].&quot; |
| positive feedback | &quot;Good for us, that kind of research. We’re thankful for them [researchers] caring about our hygiene and ES. Many people don’t know about this area because it’s rural... very good when they come here. Some communes can’t have a program like this.&quot; |
| welcome | &quot;They approach people in a gentle way... friendly so people also welcome them. When they request or ask for something, need some information, people provide it&quot; |
| Research process collected data | &quot;Validate household responses, interviewed with questionnaires, take samples, sent those samples to them [researchers]&quot; |</p>
<table>
<thead>
<tr>
<th>priorities</th>
<th>Relevant for what researcher's think are important</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&quot;For the project objective, we had to make sure it was an environmental health problem. The CM's main health problems were skin problems and diarrhea. Microbiologist more concerned about the chemical/heavy metal polluted in ww but our background on the health, about the diarrhea diseases and parasite infection. Our study objective and the main problem in the study site did not match.&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>results/information sharing</th>
<th>Results and objectives are shared with the stakeholders in different ways</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&quot;Already presented [results] in some conferences... short papers...organised workshop for CM.&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;Inform them [Health Station] what has been done, challenges in conducting the interview or collecting data... Not too much, we met some village leaders because they’re very close with households, provided informal feedback for us [from households]&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;NCCR’s approach...needs a lot of people to take part in...related to many people from Institute level, many graduate students...in the CM, not just people in the HS; also the CPC, WU, Farmer's Union, irrigation, etc. It means they have to participate in everything so we can get information which focuses our research...I don't know if it's like ecohealth but it's one approach of the project. And as you know, we also inform CM and receive feedback from...&quot;</td>
</tr>
<tr>
<td>Change outcomes</td>
<td>The perception that using the research results will result in visible changes (like behavioural change, policies)</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CMs' ability to implement changes</td>
<td>CMs' ability to implement changes depends on their income (income is their first priority)</td>
</tr>
</tbody>
</table>

"You do research, you have outputs...report, workshop, scientific paper, or Master's thesis. But outcome is the way people in CM or stakeholders use outputs to make change in their lives...what we call behavioural change...Outcome in our research won't make people change behaviours. For ex., at the community level, they realise ww is bad to be exposed to, but they can't stop using it, so they can just wear gloves or use good protective measures...it can reduce health risk."

"People know that environment is important and negatively influences health, but their economic status is not good, so they don't do anything [about sanitation] even though they know that. They have to consider if they can afford it, if not, they will pass it, they have to accept reality."

1CM – community member; 2VHW – village health worker; 3ES – environmental sanitation; 4HS – health station; 5WU – Women’s Union; 6HES – health and environmental sanitation; 7MFA – Material Flow Analysis; 8HSW – health station worker; 9QMRA – Quantitative Microbial Risk Assessment
<table>
<thead>
<tr>
<th>Category</th>
<th>Theme</th>
<th>Explanation</th>
<th>Selected Quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enablers</td>
<td>Capacity development</td>
<td>See Table 3.4</td>
<td>&quot;Need to find compromise between you [researcher], the community and policy-makers to plan interventions. But when you implement, I think we need the strong willingness of the CPC, HS, other mass organizations, and the community.&quot;</td>
</tr>
<tr>
<td></td>
<td>Consensus</td>
<td>Agreement among groups</td>
<td>&quot;It’s mainly the WU. If they have their meeting, I would like to have a meeting in this commune about ES. Because they [women] are in charge of housework and going to the field. I would like to have a meeting with them because they mainly clean the road. The men don’t do it. The custom is like that.&quot;</td>
</tr>
<tr>
<td></td>
<td>Equity</td>
<td>Accounting for differences among different groups (gender, stakeholder level, social status, etc.)</td>
<td>&quot;The people knew before that there was pollution, or now through the researchers, it has been found what the main influences are. Why they are infected with helminths? Or where does the diarrhea come from? They can be aware of that now. It was vague before.&quot;</td>
</tr>
<tr>
<td></td>
<td>Evidence</td>
<td>The research provides evidence that the community can use</td>
<td>&quot;When they [the researchers] come, they often ask if we have any concerns [regarding research]. If yes, we will discuss with them so that it’s easier to do.&quot;</td>
</tr>
<tr>
<td></td>
<td>Free to express concerns</td>
<td>HSWs and CMs were free to ask researchers questions if they don’t understand the survey questions</td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>Financial contributions from collaborators</td>
<td>&quot;We need financial support to clean and rebuild the facilities so that the environment can be improved. Without funding, the drains would never be clean.&quot;</td>
<td></td>
</tr>
<tr>
<td>HS is our voice for health concerns</td>
<td>Through the HS, the community can voice opinions to the CPC</td>
<td>&quot;We will give our opinions to the HHS in a monthly meeting. The HS will collect all the opinions and submit them to the upper levels.&quot;</td>
<td></td>
</tr>
<tr>
<td>Interaction Networks</td>
<td>See Table 3.4</td>
<td>&quot;I would go to approach them [policy-makers] once I have more evidence and in particular, a bigger network...people working in the Ministry [of Health]...Environment, in the University, in the Institute. We can have some kinds of recognition when we can talk with them.&quot;</td>
<td></td>
</tr>
<tr>
<td>Pluralism</td>
<td>Multiple methods and perspectives, include multiple stakeholders at different levels</td>
<td>&quot;With one person, the problem can't be seen comprehensively but a group of researchers with the same idea about improving environment for health, there will be many researchers joining and thus, many ideas contributed from many sides. About research with community’s participation, if we have the participation of the community, the information will be more reliable and timely.&quot;</td>
<td></td>
</tr>
<tr>
<td>Research in partnership</td>
<td>Decisions on research made together among partners involved in the research</td>
<td>&quot;We discuss together, identify the problem together and we will do research together with the resources we already have. We are also willing to discuss with people to find other funds, other support to support our common interest.&quot;</td>
<td></td>
</tr>
<tr>
<td>Sharing process</td>
<td>See Table 3.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testing and monitoring</td>
<td>Recognize that ES is an on-going, long-term issue in their community and the need to test and monitor the situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VHWs shared knowledge gained</td>
<td>VHWs share what they have learned through the research with others in their community.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impediments</td>
<td>Lack of acceptance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impediments</td>
<td>People don’t want to do what differs from conventional ways of doing things.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

"I also want the people from the environment section to come here and take the [water] sample for testing so that we can know. Or when you do research, you know the information and you will share information with us so that we can learn from experience."

"By talking, for example, with the women here (VHWs) or the neighbours talk with each other or when we have a [WU] meeting."

"For [this school], if you look at the topic of Master’s thesis, almost all topics were done in a classical way: epidemiological survey, cross-sectional study...and what they [students] don’t want is to design a study, going to the field, taking samples like [our MSc student] to do analysis. Because [the students] are already staffs in different institution so they have a database...to analyse."
<p>| Limited participation | CMs and HSWs want to participate (in interventions) as much as their abilities will allow them but think they are limited by their knowledge, abilities, time, resources, funding, etc. | &quot;The HS just advocates. We (HSW) have to depend on many things. We don’t have any funding. We just advocate by using loudspeakers or through the VHWs. We also have some campaigns to collect garbage and in general, that's all we can do. It mainly depends on the CPC.&quot; |
| Not comfortable | Differing education levels and professional backgrounds can impede communication among some stakeholders | “They [the researchers] are nice and enthusiastic but just our ability is limited. When we [VHWs] meet them [we don’t feel very comfortable] because we are not highly educated, we can’t keep up with them.” |
| Terminology | Lack terminology in the language; hard to express ecohealth concept for others to understand | &quot;Actually it [the Vietnamese language] doesn't have it [the ecohealth concept] now. I, myself, can’t find any Vietnamese word for researchers to understand it clearly. Maybe if someone can combine all the ideas of those people [perspectives of ecohealth], the definition of ecohealth can be clearer.&quot; |</p>
<table>
<thead>
<tr>
<th>They just ask, no results</th>
<th>CMs that were not invited to presentations on the research progress thus far, expressed frustration with years of research and seeing no changes as a result of the research.</th>
<th>&quot;The people hope that after the research is done, [researchers] will soon have solutions so that they know the situation [in our commune]. If you just come and ask many times without results, they will say ‘they come here and ask many times, take the water samples but we haven’t seen any results’.&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t understand</td>
<td>HSWs and CMs don’t understand the research results when they aren’t involved in the research, which limits their participation in interventions</td>
<td>&quot;If I [HSW] participated, I could understand better. If they [CMs] didn’t participate and they just attended to listen to the results, they couldn’t understand it. When the researchers come here to present the results, they just present briefly. They do not show them in detail so it’s quite difficult to understand.&quot;</td>
</tr>
<tr>
<td>Integration is not clear</td>
<td>Integration of research components is not clear; integration of results is anticipated.</td>
<td>&quot;Research components were done in the same case study, same place, same communes. The concepts were developed with the expectation that we integrate information for the 3 components like health, environment, and social research. So we did it [the research]. But the integration is not clear...we need to explore further results to see the link between the 3 components.&quot;</td>
</tr>
<tr>
<td>Lack of interaction</td>
<td>Difficult to maintain a relationship with stakeholders that they don’t have a lot of direct interaction with</td>
<td>&quot;We go regularly to meet them to update about the work... the outputs of the research...I’m talking about the health worker level because in the end you can’t have a lot of relationship with the participants from the community.&quot;</td>
</tr>
<tr>
<td>Priorities</td>
<td>See Table 3.4</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------------</td>
<td></td>
</tr>
</tbody>
</table>

1. CPC – Communal People’s Committee (local government);
2. HS – health station;
3. WU – Women’s Union;
4. ES – environmental sanitation;
5. HSW – health station worker;
6. CM – community member;
7. HHS – head of health station;
8. VHW – village health worker
### Table 3.6  Input from community members on solutions, roles, and signs of improvement for health and environmental sanitation

<table>
<thead>
<tr>
<th>Community-identified ideal solutions or community roles in environmental sanitation</th>
<th>Community-identified signs of improvements in health and environmental sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use a biogas oven (converts waste into fuel)</td>
<td>Cleaner roads (no more garbage thrown randomly)</td>
</tr>
<tr>
<td>Burn garbage</td>
<td>Everyone gathers household garbage for a garbage collector; identified the need for regulations.</td>
</tr>
<tr>
<td>Treat excreta to get rid of smell or compost it properly</td>
<td>Economic status is better</td>
</tr>
<tr>
<td>Lead by example for by making changes and other people will follow if they see changes</td>
<td>Improved health means we can do anything</td>
</tr>
<tr>
<td>Need funding</td>
<td>Reduction in diseases and conditions they perceived to result from poor sanitation (diarrheal diseases, skin diseases, cancer)</td>
</tr>
<tr>
<td>Need awareness &amp; understanding</td>
<td>No smell (from garbage, animal carcasses thrown into the river, and the wastewater itself)</td>
</tr>
<tr>
<td>Need clean water system and wastewater treatment system</td>
<td>No wastewater visible (for human exposure)</td>
</tr>
</tbody>
</table>
Table 3.7 Assessment of the case study project consistency with ecohealth components identified in Chapter 2.

<table>
<thead>
<tr>
<th>Ecohealth Component</th>
<th>Component Explanation</th>
<th>Corresponding Project Elements</th>
<th>Source of Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>- from the beginning, stakeholders (including affected population) collaborate on various research stages using local knowledge and addressing some of their priorities; also refers to participatory action research</td>
<td>- participation from member of local institutions and community members consists of providing information for the researchers’ project and helping them collect data</td>
<td>- interview themes: “collected data”, “limited participation” (Table 3.4 &amp; 3.5)</td>
</tr>
<tr>
<td>System</td>
<td>- understanding the whole and its parts (issues, interactions, key actors, components, and interrelationships); includes systems science</td>
<td>- could not tell at this point in the project</td>
<td>N/A</td>
</tr>
<tr>
<td>Multidisciplinary</td>
<td>- more than two disciplines working together in their traditional roles</td>
<td>- epidemiology, public health, environmental engineering</td>
<td>- project documents (Table 3.3)</td>
</tr>
<tr>
<td>Action-oriented</td>
<td>- results in something done to solve or mitigate the research problem under study</td>
<td>- no interventions or changes planned thus far - intend to address this in next phase of research</td>
<td>- interview with project lead</td>
</tr>
<tr>
<td>Complexity</td>
<td>- made up of many interrelated parts; where ecohealth is best applicable</td>
<td>- research questions of individual components of the project do not address complexity of the health and environmental sanitation issue</td>
<td>- project documents (See Table 3.3 and Figure 3.4)</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Long-term</td>
<td>- ecohealth requires a time-commitment; improvements/outcomes might only be seen in the future; difficult to contain within a single project</td>
<td>- data collection started in 2008; next phase of research expected to last until 2013- project involved multiple components</td>
<td>- project documents (Table 3.3)</td>
</tr>
<tr>
<td>Indicators</td>
<td>- measures used for study outcomes and monitoring should be developed by involved stakeholders and may be different according to each group</td>
<td>- community-identified indicators have not been discussed with the researchers or addressed thus far</td>
<td>- interview themes: “community identified signs of improvement” (Table 3.6)</td>
</tr>
<tr>
<td>Adaptive management</td>
<td>- an iterative learning process with stakeholder participation involving monitoring, evaluating, and adjusting the plan based on the information generated in the process</td>
<td>- could not tell at this point in the project</td>
<td>N/A</td>
</tr>
<tr>
<td>Transdisciplinarity</td>
<td>- collaboration between researchers and practitioners from complimentary disciplines/sectors and/or other stakeholders on a problem; uses multiple methods/tools that facilitate the generation of new frameworks, concepts, methods, institutions, etc. from the knowledge sharing and/or interaction</td>
<td>- integration of research components is not clear; integration of results is anticipated, but how this will happen is also not clear</td>
<td>- interview theme: “integration is not clear” (Table 3.5)</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Equity</td>
<td>- addresses differences between groups affected by research problem; gender (roles, responsibilities), power (decision making, access to resources), and trade-offs (who benefits)</td>
<td>- statistical analysis of data has been stratified by gender</td>
<td>- interview with PhD student (health research component)</td>
</tr>
<tr>
<td>Sustainability</td>
<td>- meeting the needs of current generations without compromising the needs of future generations; the outcome or goal of ecohealth, also refers to sustainability of the environment and/or of interventions/projects</td>
<td>- could not tell at this point in the project</td>
<td>N/A</td>
</tr>
</tbody>
</table>
| **Socio-ecological** | - understanding the human and environmental components of a problem and their interaction | - health component quantifies human health risks and exposure  
- social component examines perceptions & behaviours  
- environmental component quantifies nutrient flows in agricultural & sanitation system  
- the interaction between components not addressed yet, as integration is not clear | - project document (Table 3.3)  
- interview theme: “integration is not clear” (Table 3.5) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SOHOs (self-organizing, holarchic open system)</strong></td>
<td>- characterized by holarchy (interactions between nested hierarchies), feedback loops (consequences for another part of the system – positive or negative), self-organization (combination of feedback, boundaries, and openness)</td>
<td>- could not tell at this point in the project</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Negotiate</strong></td>
<td>- a process in which the decisions on objectives, methods, and indicators are made with stakeholders</td>
<td>- the research was conducted according to what the researchers’ priorities, mainly driven by a conceptual framework developed a priori</td>
<td>- interview theme: &quot;priorities&quot; (Table 3.4)- project document (Figure 3.1)</td>
</tr>
</tbody>
</table>
**Figure 3.1** Conceptual framework of the combination of health and environmental risk assessment for health and environmental sanitation planning. EPI: Epidemiology, QMRA: Quantitative Microbial Risk Assessment, MFA: Material Flow Analysis, SSA: Social Science Analysis (Nguyen-Viet, H., et al., 2009.)
Figure 3.2  Open drainage system (left) and Nhue River containing untreated wastewater flowing from Hanoi (right) in Hoang Tay Commune, Kim Bang District, Hanam Province, North Vietnam

Photo: Vi Nguyen
Figure 3.3: Environmental, social, economic, and health aspects of the problem from a research perspective (*from Hanoi, ** in rural areas, ww: wastewater)

In agriculture, farmers use:
- human & animal excreta as fertilizer to reduce costs associated with artificial fertilizers
- water from heavily polluted Nhue & Day River for irrigation
- not aware of hazards from the water/lack other options
Local authorities & community
- lack awareness of need for improved environmental sanitation & health risks

Recycling of nutrients: uses human excreta for food production (↓ use of chemical fertilizer, ↓ pollution of water & soil)
- ww & human excreta contamination of food
- ↑ exposure of farmers to pathogens
- protozoa, bacteria, viruses, helminths
- enteric & skin diseases
**2003: 50% of infectious disease attributable to environmental sanitation

Large growth in population & economy
- environmental sanitation not caught up with growth
- *ww from hospitals, industry, households, commercial, construction
- *runoff from paddies, cereal fields, vegetable & fruit gardens
- large amounts of agrochemicals, applied intensely to ↑ yields
- nutrient cycles damaged, eutrophication of lakes, soil & water quality deterioration
*most of the untreated ww ends up in Nhue & Day River
- lots of flooding during rainy season
- ww high in nitrogen, phosphorus & bacteria
- solid waste management: not properly collected or separated
**housing: limited space, livestock situated near house & water resources
**2006: 52% of rural houses have sanitary latrines
- simple septic tanks, cesspits, overhung toilets
Figure 3.4 Stakeholders affected by the issues of environmental sanitation and related to the NCCR research project

Vietnamese Partners:
HCPM: Hanam Centre for Preventative Medicine
HSPH: Hanoi School of Public Health
NIHE: National Institute of Hygiene and Epidemiology
HSPH: Hanoi School of Public Health

Swiss Partners:
Swiss TPH: Swiss Tropical and Public Health Institute
Eawag: Swiss Federal Institute of Aquatic Science and Technology

Southeast Asian Partner (Thailand):
AIT: Asian Institute for Technology
CHAPTER FOUR
SUMMARY DISCUSSION AND CONCLUSIONS

Over the past decade, various Canadian and international initiatives such as the Population Health Approach, Global Health Research Initiative, Millennium Ecosystem Assessment, and One Health Initiatives have stressed the imperative of moving towards more integrated and holistic approaches in areas as diverse as public health, ecology, and other health and environmental disciplines (Canadian Institutes of Health Research, 2007; Corvalan, Hales, & McMichael, 2005; PHAC, 2009; Public Health Agency of Canada, 2001). This is perhaps attributable to increasing complexity of local and global issues like emerging infectious diseases, climate change, and food security, which both affect and are affected by multiple sectors and a wide range of stakeholders. Ecosystem approaches to health (ecohealth) have been acclaimed a way of dealing with such challenges (Webb et al., 2010). However, clarification of the ecohealth concept and practice has been called for, as there has been increasing interest in this area among the public health community (PHAC, 2009). This thesis aimed to investigate the concept and practice of ecohealth within the context of public health using qualitative methods. A scoping review of the literature was conducted to extract explanations of the ecohealth concept from the published literature and describe its practice, using commentaries and primary research, respectively (Chapter 2). To complement this understanding, a case study approach was undertaken by conducting interviews and focus group discussions
with stakeholders to identify enablers and impediments of ecohealth and how concepts were integrated into a research project of health and environmental sanitation in Vietnam (Chapter 3).

The scoping study allowed us to help clarify the ecohealth concept by identifying important concepts and definitions in ecohealth, which were expressed in the form of a mind map showing interconnections between themes and as a table of explanations. Investigation of ecohealth practice through primary research proved to be difficult, as most articles (27/29) indicated using the approach by citing the International Development Research Centre’s (IDRC) pillars of ecohealth (transdciplinarity, participation, and equity) (IDRC, 2005), rather than explicitly explaining their methodological details, as they related to ecohealth. This process led us to identify a need for a reporting framework to facilitate greater transparency in reporting of ecohealth studies.

After examining the themes arising from our case study (Chapter 3), we think that they could form the basis of such a framework, and these are presented as guidelines in Table 4.1. The guidelines are centred around the pillars of ecohealth because some of the themes helped us identify what needed to be explained in order for the reader to understand the approach taken in a given study. Themes like “interaction” and “integration is not clear” highlighted a need to report on outputs, such as the formation of networks and integration. Reporting of community-identified aspects of the investigated issue and categorization of the type of participation was drawn from “community opinion and priorities” and “limited participation”. A variety of themes, including “gains
from the research” and “testing and monitoring” pointed to the need for addressing how sustainability of the research efforts would be attempted after a project ends. The approach should therefore be explained in a way that the reader could critically appraise it. We acknowledge that these guidelines may not be complete or robust, but could be adapted or developed further for other contexts and tested for other cases or beyond local, community-level studies. They represent some of the issues that one should think about when designing, implementing, and evaluating this type of research. This may support more rigorous application of ecohealth concepts and be of interest to funders, practitioners, policy and decision-makers, and journals publishing this type of research.

As a methodology, the scoping study aimed to be comprehensive, rigorous, and transparent. Despite systematic efforts to identify relevant research, we may have missed some studies that met a description of ecohealth but didn’t use “ecohealth” or any of the other related search terms in their title, keywords, or abstract, thereby evading capture by our search strategy. However, the EcoHelath Journal, which is currently known for publishing most of the articles in the area, was indexed within the databases we searched (Anonymous, n.d.). Due to time and resource constraints, searching books was not feasible for the review, and this practice is usually secondary to peer-reviewed, primary research. We suspect that more extensive searching would not have contributed substantially to our review because we analyzed commentaries until data
saturation was achieved and most of the primary research did not explain implementation of ecohealth within the context of their studies.

It is important to note that the field work for Chapter 3 was initiated before the data for Chapter 2 were analyzed. Ideally, the results of the scoping review should have been used to inform development of the investigation questions (both research questions and interview and focus group questions). On the other hand, insights gained from conducting the field work for the case study were useful in interpreting the data in the scoping review. Construction of investigation questions was partly informed by familiarity with existing literature, but had to be altered according to the context of the field work; abstract and full paper relevance screening was completed by the time field work in Vietnam began. It was the reflection on field work activities, the nature of interactions and sharing of information among between stakeholders, and the complexity of the issues under study that mutually reinforced understanding of ecohealth concepts in the literature. Understanding of ecohealth was facilitated both by the experience of conducting the case study and by drawing on literature from other areas. For example, in the health promotion literature, it is acknowledged that many of the determinants of health lie outside of what is traditionally considered the health sector (e.g. economic status). This requires us to think even beyond prevention and control activities (health protection), which focus on diseases and pathogens, if we want to address the root causes of diseases (World Health Organization, 2009). Another example lies in some of the underlying assumptions in qualitative research, which use a more heurisitic view that multiple realities are possible,
which differs from quantitative research that assumes a single objective reality independent of experience, which allows one to generalize their research findings (Patton, 2002). This underscores the importance of perspectives from other disciplines, but extends further than scientific knowledge and is inclusive of cultural and local knowledge, for example. Inclusion of the qualitative research and going beyond scientific knowledge form part of a starting point for addressing the complexity of the issue under study.

Language and terminology surfaced in both chapters as issues for ecohealth. It challenging and sometimes impossible for some people to participate in discussions that span diverse disciplines or sectors, particularly if they lack context-specific knowledge or background in an area. How could this be addressed? The use of participatory techniques, mostly diagramming, which tends to be used when working with communities, is one suggestion (Kesby, 2000).

Our scoping review of the literature and case study investigation were both useful in highlighting that there is no prescriptive process for implementing ecohealth. The existing frameworks provide guidelines for processes to operationalizing the concepts, which have to be adaptive to the issues and people involved. Within these frameworks, the appropriate methods and tools will differ according to the nature of the research question. This raises the issues of the development of newer tools and methods for ecohealth, which is related to the challenges in implementing ecohealth in practice. Although the individual concepts that form ecohealth (participation and transdisciplinarity, for example)
are not new, the connection of these concepts into a framework for doing research is relatively new. So, perhaps existing tools and methods have not sufficiently caught up with development of the concept, which is aimed at addressing complexity. This raises the question of whether we are using old tools and old ways of thinking to address increasingly complex problems. The field of ecohealth would benefit from developments in this area.

Both the clarification of concept and the knowledge of the gaps in practice of ecohealth that were identified in this thesis are useful for a variety of end-users. Funders and journal reviewers may use these as guidelines for evaluating proposals and submitted articles. Our findings offer issues for practitioners and researchers interested in these approaches to think about in the design and implementation of the research. To go beyond research, policy and decision-makers may be interested in our synthesized understanding of ecohealth and reading case studies that clearly explain their experience of the practice of ecohealth in order to formulate policies that facilitate integrated and holistic approaches within government agencies and other organizations. Further work should focus on building on reporting guidelines presented in this chapter, as this would guide design, implementation, reporting, and evaluating this type of work, which is necessary to strengthen the field of ecohealth.
REFERENCES


<table>
<thead>
<tr>
<th>Pillar of ecohealth</th>
<th>Suggested guideline for reporting approach or questions to consider</th>
<th>Suggested question(s) to consider for reporting and evaluation of approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transdisciplinarity &amp; Equity</td>
<td>Established network of stakeholders as a diagram showing interconnections, a table explaining their roles &amp; responsibilities &amp; identified gaps</td>
<td>Who was this output developed and discussed with? Was the process documented &amp; reported in the research?</td>
</tr>
<tr>
<td></td>
<td>Diagrammatic representation of aspects of integration and textual explanations</td>
<td>What kind of knowledge/data was integrated (type of data, which sector/discipline)? Who's knowledge was integrated (which stakeholders)? What methods/tools were used for integration? Why was this necessary? When did this happen during the research process?</td>
</tr>
<tr>
<td>Participation</td>
<td>Report a list of community-identified ideal solutions, roles, and indicators for improvement in the situation</td>
<td>How do these list differ among stakeholder groups?</td>
</tr>
<tr>
<td></td>
<td>Categorize the mode of participation under contractual, consultative, collaborative, or collegiate and explain this using roles &amp; responsibilities of stakeholders throughout the research process¹.</td>
<td>How do the stakeholders feel about the categorized mode of participation? What more or less would they like to contribute?</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Map out or use textual explanations of any specific plans for continued research efforts/interventions/testing &amp; monitoring/results dissemination, developed with community members</td>
<td>What skills/tools/methods have been gained or will be used in subsequent efforts?</td>
</tr>
</tbody>
</table>

¹Research process: problem identification, establishment of priorities & objectives, research implementation, analysis, results dissemination
Appendix 2.1 The finalized search strategy with tailored algorithms for each database

CAB Direct (University of Guelph) - Platform: CAB
free text search in all fields
Date searched: June 30, 2008
Years covered: 1970 - present

<table>
<thead>
<tr>
<th>Algorithm 1</th>
<th>Articles hit</th>
<th>Articles saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Terms: ecosystem or ecosystems or environment or environments or human or humans or population or populations or development or developments or agricultural or agriculture</td>
<td>4096737</td>
<td></td>
</tr>
<tr>
<td>Intervention Terms: ecosystem approach or ecosystem approaches or ecohealth or ecosystem management or ecosystem health</td>
<td>2470</td>
<td></td>
</tr>
<tr>
<td>Outcome Terms: human health or well-being or well being or sustainability or sustainable or healthy environment or health status or public health or biodiversity or disease or diseases or mortality or mortalities or death or deaths or quality of life or concentration or concentrations or air quality or water quality or radiation or environmental health</td>
<td>3332426</td>
<td></td>
</tr>
<tr>
<td>Combination: (population) AND (intervention) AND (outcome)</td>
<td>1398</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Algorithm 2</th>
<th>Articles hit</th>
<th>Articles saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contextual Situation Terms: information or wisdom or disease surveillance or uncertainty or uncertainties or education or medicine or agricultural or agriculture or policy or policies or risk or animal health</td>
<td>1718059</td>
<td></td>
</tr>
<tr>
<td>Intervention Terms: ecosystem approach or ecosystem approaches or ecohealth or ecosystem management or ecosystem health or ecosystem medicine</td>
<td>2470</td>
<td></td>
</tr>
<tr>
<td>Combination: (contextual situation) AND (intervention)</td>
<td>1296</td>
<td></td>
</tr>
<tr>
<td>(Algorithm 1) OR (Algorithm 2)</td>
<td>1899</td>
<td>1899</td>
</tr>
</tbody>
</table>
**Environmental Sciences and Pollution Management (University of Guelph) - Platform: CSA**

Free text search in keywords section (includes title, abstract, descriptors)

Date searched: July 2, 2008

Years covered: 1970 - present

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Articles hit</th>
<th>Articles saved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Algorithm 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Population Terms</strong>: ecosystem or ecosystems or environment or environments or human or humans or population or populations or development or developments or agricultural or agriculture</td>
<td>757119</td>
<td></td>
</tr>
<tr>
<td><strong>Intervention Terms</strong>: ecosystem approach or ecosystem approaches or ecohealth or ecosystem management or ecosystem health</td>
<td>7045</td>
<td></td>
</tr>
<tr>
<td><strong>Outcome Terms</strong>: human health or well-being or well being or sustainability or sustainable or healthy environment or health status or public health or biodiversity or disease or diseases or mortality or mortalities or death or deaths or quality of life or concentration or concentrations or air quality or water quality or radiation or environmental health</td>
<td>695609</td>
<td></td>
</tr>
<tr>
<td><strong>Combination</strong>: (population) AND (intervention) AND (outcome)</td>
<td>3093</td>
<td></td>
</tr>
<tr>
<td><strong>Algorithm 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Contextual Situation Terms</strong>: information or wisdom or disease surveillance or uncertainty or uncertainties or education or medicine or agricultural or agriculture or policy or policies or risk or animal health</td>
<td>333528</td>
<td></td>
</tr>
<tr>
<td><strong>Intervention Terms</strong>: ecosystem approach or ecosystem approaches or ecohealth or ecosystem management or ecosystem health or ecosystem medicine</td>
<td>7045</td>
<td></td>
</tr>
<tr>
<td><strong>Combination</strong>: (contextual situation) AND (intervention)</td>
<td>2881</td>
<td></td>
</tr>
<tr>
<td>(Algorithm 1) OR (Algorithm 2)</td>
<td>4549</td>
<td>4515</td>
</tr>
</tbody>
</table>

Note: Only published citations can be saved.
Medline (National Library of Medicine) - Platform: PubMed
free text search in all fields, used quotations for phrase search and to turn off term mapping
Date searched: July 1, 2008
Years covered: 1970 - present

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Articles hit</th>
<th>Articles saved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Algorithm 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Population Terms:</strong> “ecosystem” or “ecosystems” or “environment” or “environments” or “human” or “humans” or “ecosystem service” or “ecosystem services” or “population” or “populations” or “environmental change” or “environmental changes” or “ecological change” or “ecological changes” or “environmental contamination” or “environmental degradation” or “development” or “developments” or “European land management” or “Indigenous land management” or “ecosystem change” or “ecosystem changes” or “wildlife health” or “human activity” or “human activities” or “ecosystem distress syndrome” or “information” or “wisdom” or “biomedical survey” or “biomedical surveys” or “disease monitoring” or “disease surveillance” or “veterinarian” or “veterinarians” or “veterinary advisor” or “veterinary advisors” or “ecology” or “ecologies” or “interdisciplinary” or “medical education” or “veterinary medicine” or “transdisciplinarity” or “curriculum” or “curriculums” or “curricula” or “problem solving” or “transdisciplinary thinking” or “uncertainty” or “uncertainties” or “veterinary curriculum” or “veterinary curriculums” or “veterinary curricula” or “pedagogy” or “pedagogies” or “Millennium Development Goals” or “education” or “medicine” or “agricultural” or “agriculture” or “school” or “schools” or “policy” or “policies” or “risk”</td>
<td>11625227</td>
<td></td>
</tr>
<tr>
<td><strong>Intervention Terms:</strong> “ecosystem approach” or “ecosystem approaches” or “ecohealth” or “ecosystem management” or “ecosystem health”</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Outcome Terms:</strong> “human health” or “well-being” or “well being” or “sustainability” or “sustainable” or “healthy environment” or “health status” or “public health” or “communicable disease” or “communicable diseases” or “infectious disease” or “infectious diseases” or “biodiversity” or “emerging disease” or “emerging diseases” or “disease” or “diseases” or “morbidity” or “mortalities” or “mortality” or “mortalities” or “quality of life” or “life expectancy” or “disability” or “disabilities” or “zoonoses” or “zoonosis” or “zoonotic disease” or “zoonotic diseases” or “death” or “deaths” or “concentration” or “concentrations” or “air quality” or “water quality” or “radiation” or “environmental health”</td>
<td></td>
<td>5151403</td>
</tr>
<tr>
<td><strong>Combination:</strong> (population) AND (intervention) AND (outcome)</td>
<td></td>
<td>308</td>
</tr>
</tbody>
</table>

Algorithm 4

129
Contextual Situation Terms: “information” or “wisdom” or “biomedical survey” or “biomedical surveys” or “disease monitoring” or “disease surveillance” or “veterinarian” or “veterinarians” or “veterinary advisor” or “veterinary advisors” or “interdisciplinary” or “medical education” or “veterinary medicine” or “transdisciplinarity” or “curriculum” or “curriculums” or “curricula” or “problem solving” or “transdisciplinary thinking” or “uncertainty” or “uncertainties” or “veterinary curriculum” or “veterinary curriculums” or “veterinary curricula” or “pedagogy” or “pedagogies” or “Millennium Development Goals” or “education” or “medicine” or “agricultural” or “agriculture” or “school” or “schools” or “policy” or “policies” or “risk” or “physician” or “physicians” or “biologist” or “biologists” or “ecologist” or “ecologists” or “environmental scientist” or “environmental scientists” or “multidisciplinary” or “zoonotic” or “zoonoses” or “zoonosis” or “health promotion” 4247140

Intervention Terms: “ecosystem approach” or “ecosystem approaches” or “ecohealth” or “ecosystem management” or “ecosystem health” 483

Combination: (contextual situation) AND (intervention) 314
(Algorithm 3) OR (Algorithm 4) 406

GreenFILE (Health Canada) - Platform: EBSCOhost
free text search in all fields, used quotations for phrase search and to turn off term mapping
Date searched: July 3, 2008
Years covered: 1970 - present

<table>
<thead>
<tr>
<th>Search terms</th>
<th>Articles hit</th>
<th>Articles saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algorithm 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population Terms: “ecosystem” or “ecosystems” or “environment” or “environments” or “human” or “humans” or “ecosystem service” or “ecosystem services” or “population” or “populations” or “environmental change” or “environmental changes” or “ecological change” or “ecological changes” or “environmental contamination” or “environmental degradation” or “development” or “developments” or “European land management” or “Indigenous land management” or “ecosystem change” or “ecosystem changes” or “wildlife health” or “human activity” or “human activities” or “ecosystem distress syndrome” or “information” or “wisdom” or “biomedical survey” or “biomedical surveys” or “disease monitoring” or “disease surveillance” or “veterinarian” or “veterinarians” or “veterinary advisor” or “veterinary advisors” or “ecology” or “ecologies” or “interdisciplinary” or “medical education” or “veterinary medicine” or “transdisciplinarity” or “curriculum” or “curriculums” or “curricula” or “problem solving” or “transdisciplinary thinking” or “uncertainty” or “uncertainties” or “veterinary curriculum” or “veterinary curriculums” or “veterinary curricula” or “pedagogy” or “pedagogies” or “Millennium Development Goals” or “education” or “medicine” or “agricultural” or “agriculture” or “school” or “schools” or “policy” or “policies” or “risk”</td>
<td>239691</td>
<td>1823</td>
</tr>
</tbody>
</table>
**Intervention Terms:** “ecosystem approach” or “ecosystem approaches” or “ecohealth” or “ecosystem management” or “ecosystem health” or “ecosystem medicine” 2459

**Outcome Terms:** “human health” or “well-being” or “well being” or “sustainability” or “sustainable” or “healthy environment” or “health status” or “public health” or “communicable disease” or “communicable diseases” or “infectious disease” or “infectious diseases” or “biodiversity” or “emerging disease” or “emerging diseases” or “disease” or “diseases” or “morbidity” or “morbidities” or “mortality” or “mortalities” or “quality of life” or “life expectancy” or “disability” or “disabilities” or “zoonoses” or “zoonosis” or “zoonotic disease” or “zoonotic diseases” or “death” or “deaths” or “concentration” or “concentrations” or “air quality” or “water quality” or “radiation” or “environmental health” 105352

**Combination:** (population) AND (intervention) AND (outcome) 1260

**Algorithm 4**

**Contextual Situation Terms:** “information” or “wisdom” or “biomedical survey” or “biomedical surveys” or “disease monitoring” or “disease surveillance” or “veterinarian” or “veterinarians” or “veterinary advisor” or “veterinary advisors” or “interdisciplinary” or “medical education” or “veterinary medicine” or “transdisciplinarily” or “curriculum” or “curriculums” or “curricula” or “problem solving” or “transdisciplinary thinking” or “uncertainty” or “uncertainties” or “veterinary curriculum” or “veterinary curriculums” or “veterinary curricula” or “pedagogy” or “pedagogies” or “Millennium Development Goals” or “education” or “medicine” or “agricultural” or “agriculture” or “school” or “schools” or “policy” or “policies” or “risk” or “physician” or “physicians” or “biologist” or “biologists” or “ecologist” or “ecologists” or “environmental scientist” or “environmental scientists” or “multidisciplinary” or “zoonotic” or “zoonoses” or “zoonosis” or “health promotion” 134607

**Intervention Terms:** “ecosystem approach” or “ecosystem approaches” or “ecohealth” or “ecosystem management” or “ecosystem health” or “ecosystem medicine” 2459

**Combination:** (contextual situation) AND (intervention) 1343

**(Algorithm 3) OR (Algorithm 4)** 1823
Appendix 2.2 Relevance Screening Tool I – Dec. 18, 2008

The goal of Relevance Screening Tool I is to identify potentially relevant primary research or discussion papers on ecosystem health. Please see definitions below for terms that are bolded and underlined and instructions for reviewer decision.

1. Does this abstract investigate **ecosystem health**? Check all that apply.
   - Yes, **primary research** in English (include)
   - Yes, **primary research** in foreign language (exclude)
   - Yes, commentary/editorial/discussion/literature review in English (include)
   - Yes, commentary/editorial/discussion/literature review in foreign language (exclude)
   - Yes, articles provides information on developing/delivering/assessing **training** in **ecosystem health** (exclude)
   - Yes, **whole publication** (exclude)
   - Can’t tell (neutral)
   - None of the above (exclude)

2. Does this abstract investigate **ecosystem health** in the context of (check all that apply)?
   - **Practices or programs** (include)
   - **Human/public health** (include)
   - **Zoonoses** (include)
   - **Animal health ONLY** (exclude)
   - **Environment or conservation ONLY** (exclude)
   - Can’t tell (neutral)
   - None of the above (exclude)

---

1 Other terms used to indicate ecosystem health may include, but are not limited to: ecosystem approach, ecohealth, ecosystem management, and ecosystem medicine.

2 Primary research may include: a study where the authors collected and analyzed their own data papers OR a paper where the author used the ecosystem health approach in their design/methodology but there must be some sort of indication that their conclusions are verifiable using data/results, even if it isn’t reported in this article.

3 Training refers to a course/training delivered by a professional affiliated with an institution (eg. educational, governmental, non-governmental organization [NGO]).

4 Whole publications include entire conference proceedings and books.

5 Reviewers should only use the “can’t tell” option if the article may be relevant. If the article is obviously not relevant, “No” or “none of the above” should be selected. Full articles must be obtained for any “can’t tell” responses.

6 Practices or programs can be defined as a set of planned actions or a conceptual framework that has been or can be actually used or applied in a human/public health setting.

7 Human/public health refers to the science and practice of protecting and improving the health of individuals or a human community. The study must link the practice of ecosystem health to human/public health.

8 Zoonoses are diseases that can be transmitted between humans and animals (WHO 2008). The study must link the practice of ecosystem health to human/public health.
Animal health refers to the science and practice of protecting and improving the health of an individual or community of domestic or wild animals.

Environment or conservation only refers to papers on these topics where the authors do not link the practice of ecosystem health to human/public health.

Reviewer Decision
If the reviewer answers: (for Q1, primary research in English, commentary/editorial/discussion/literature review in English, or articles provides information on developing/delivering/assessing training in ecosystem health) AND (practice/program, human/public health, or zoonoses in Q2), the article advances to the Relevance Screening Tool II, where the full article will be used for classification.

Whole publications will be excluded for now, but they will be hand-searched and potentially relevant articles will be put through relevance screening if they are not already captured by our search strategy.

References

Appendix 2.3 Relevance Screening Tool II for Commentaries – Dec. 18, 2008

The goal of Relevance Screening Tool II for Commentaries is to classify each commentary/ editorial/ discussion/ literature review on ecosystem health using full articles.

1. When was the commentary/ editorial/ discussion/ literature review published?
   2003-present (include)
   1998-2002 (include)
   1993-1997 (include)
   Before 1993 (include)
   Can’t tell (include)

2. Does the commentary/ editorial/ discussion/ literature review provide a definition or describe what ecosystem health\(^1\) means?
   Yes (include)
   No (exclude)

3. Is ecosystem health\(^1\) defined or described in a human/public health\(^2\) context?
   Yes (include)
   No (exclude)

\(^1\) Other terms used to indicate ecosystem health may include, but are not limited to: ecosystem approach, ecohealth, ecosystem management, and ecosystem medicine.

\(^2\) Human/public health refers to the science and practice of protecting and improving the health of individuals or a human community. The study must link the practice of ecosystem health to human/public health.

Relevance Screening Tool II for Primary Research– June 10, 2009

The goal of Relevance Screening Tool II for primary research is to screen in primary articles that use an ecosystem approach in their methodology and the research is in human/public health context.

1. Do the authors state that they use an ecosystem approach\(^1\) in the article title or anywhere in body of the article?
   Yes (include)
   No (exclude)

2. Is the research performed in a human/public health\(^2\) context?
   Yes (include)
   No (exclude)

\(^1\) Other terms used to indicate an ecosystem approach may include, but are not limited to: ecosystem health, ecohealth, ecosystem management, and ecosystem medicine.

\(^2\) Human/public health refers to the science and practice of protecting and improving the health of individuals or a human community. The study must link the practice of ecosystem health to human/public health.
Appendix 2.4 Analysis Method Framework

The objective of this tool is to extract explanations of ecosystem approaches in a public health context using a framework approach for qualitative analysis.

1. Identifying initial themes or concepts
   - Become familiar with the data by reading 10 articles and write analytic memos on each (1). Analytic memos are like journal entries about the researchers thoughts on the data, the coding process, and patterns that emerge from the data (Pg 32, 33). Date each memo to keep track of the progression of the study (Pg 33). Circle or highlight passages that appear noteworthy (Pg 16).
   - Things to reflect on and write about: how you relate to the data, the research question, codes and their definitions, patterns, categories, themes, and concepts that emerge and how they are related, emergent or related existing theory, problems and/or personal or ethical dilemmas you are having relating to the study, your vision for future directions, the memos already written, or the final report for your study (Pg 34 - 39) (1)
   - Create a list of recurring themes or ideas, but also include topics that come up which are related to the research question (2). When reading, keep in mind some guiding questions: What definition or explanation of ecosystem approaches is given? How is this related to public health? The themes should be grounded in the data (i.e. It uses the language found in the data or at least stays very close to it)
   - Construct a thematic framework by sorting the themes under broader categories. This is a working framework, which can be altered as the analysis progresses.

2. Labelling or tagging data by concept or theme
   - Apply the framework to the data by reading the text in detail and asking oneself “what is this about?” Label directly on the document. Make note of interconnections between themes by looking at interspersion of themes within the data.
   - Identified themes that are not already part of the framework can be added and categories can be broken down or combined, depending on whether the data fits existing categories. If the framework is changed, go back and check that indexing has been applied consistently. Document revisions made to the framework.

3. Sorting data by theme or concept
   - Sort the data in thematic charts like in the example below. Interconnected or closely related themes should be displayed together on one chart; otherwise the themes should be displayed in separate charts. Keep each ref id on the same row of every chart to allow comparison between ref ids and themes.
4. Summarizing and synthesizing data
- Summarize by only including data that captures the content and context of what is being said.
- Work through the data systematically. Either summarize by theme for all documents or by document for all themes. Use the same kind of table as in Step 3.

5. Identifying elements and dimensions, refining categories, classifying data
- Work with each theme separately by reading the data in a column across cases. On a separate sheet, identify elements/dimensions in the data (Column B). Label the data to suggest what the data represents (Column C). At this stage, you are going from the original data to descriptive categories and this is where interpretation starts to occur. Be critical during categorization by asking yourself: is this a new category or a component of one already identified? Once the chart is filled out, make a list of the categories. Consider grouping categories that present similar concepts into the same broader category.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
<th>Column C</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summarized data from sub-theme 1</td>
<td>Elements/dimensions identified from the data</td>
<td>Category</td>
<td>Include commonalities among categories</td>
</tr>
<tr>
<td>Ref id 1, author, year, journal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Establishing typologies
- A typology is a systematic classification of types. Typologies tend to be multidimensional classifications, which have discrete and independent categories.
- Depending on what earlier steps in the analysis reveal, we may or may not create typologies because typologies are not always suitable or necessary for all qualitative studies. They are only useful if they help explain differences.

7. Detecting patterns (associative analysis and identification of clustering)
- To detect patterns of association, start by searching within cases (documents) first and then across cases individually. Look for linkages between sets of phenomena and for repetition of these linkages. Note
contradictory associations as well. Even if there is no explanatory connection, note co-existence of phenomena. This kind of search is done with the whole dataset.

- Make a summary table of these patterns
- If typologies have been established, we can look for any characteristics that are attached within certain groups.
- Verifying associations involves examining the number of times a particular phenomenon is associated with another. One can also check by searching for or developing explanations, as explained in the next step.

8. Developing explanations (answering how and why questions)
- Give explicit reasons by using the repetition, range and variety of explanations offered in the document or give explanations for patterns that occur with explicit reasons.
- Make inferences by searching for evidence that is not immediately visible using one or more of these approaches: 1) comparing unconnected themes side by side or just use their interspersion 2) repeated coexistence of phenomena, not necessarily in proximity. 3) looking at the differences between the presence and absence of phenomenon among documents.
- Use common sense to find explanations by checking if assumptions either fit a commonly existing pattern or can just be seen in the data but this kind of reasoning must be evident across the whole data set.
- A strong analytical concept which is developed during the study or analysis can itself serve as an explanation.
- Established theoretical concepts may be useful for explaining the findings (2).

References:
## Appendix 2.5 Data extraction tool for primary research that explicitly stated using an ecosystem approach, within the context of public health

<table>
<thead>
<tr>
<th>General Study Details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
<td>Categories</td>
</tr>
<tr>
<td>Ref ID from SRS</td>
<td></td>
</tr>
<tr>
<td>Journal name</td>
<td></td>
</tr>
<tr>
<td>Author(s) name</td>
<td></td>
</tr>
<tr>
<td>Publication year</td>
<td></td>
</tr>
<tr>
<td>Location of study (country/region/province/state)</td>
<td></td>
</tr>
<tr>
<td>In what year(s) was the data collected?</td>
<td></td>
</tr>
<tr>
<td>Institution(s) that funded the study</td>
<td></td>
</tr>
<tr>
<td>What was the objective of the study?</td>
<td>To implement an intervention To assess an intervention To understand community/public/stakeholder perspectives on the intervention/problem To manage/rehabilitate an ecosystem and its members (includes human health) Other, please specify: Not reported</td>
</tr>
<tr>
<td>What was the human health issue under study?</td>
<td>physical injuries/accidents chronic diseases infectious diseases environmental health social determinants of health mental health Other, please specify: Not reported</td>
</tr>
<tr>
<td></td>
<td>Chronic diseases refer those that are “prolonged, have a non-infectious, often unknown origin, several risk factors, an extended latency period, and may be linked to injuries or</td>
</tr>
</tbody>
</table>
disabilities” (PHAC 2006). Infectious diseases refer to “diseases that originate from pathogenic microorganisms such as viruses, bacteria, parasites, or fungi” (WHO 2008). Environmental health “addresses all the physical, chemical, and biological factors external to a person, and all the related factors impacting behaviours. It encompasses the assessment and control of those environmental factors that can potentially affect health. It is targeted towards preventing disease and creating health-supportive environments. This definition excludes behaviour not related to environment, as well as behaviour related to the social and cultural environment, and genetics” (WHO 2009a). The social determinants of health “are the
conditions in which people are born, grow, live, work and age, including the health system. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels, which are themselves influenced by policy choices. The social determinants of health are mostly responsible for health inequities - the unfair and avoidable differences in health status seen within and between countries” (WHO 2009b).

Mental health is “defined as a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (WHO 2009c).

<table>
<thead>
<tr>
<th>Describe the human/animal</th>
<th>- Please specify:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Not applicable</td>
</tr>
<tr>
<td>Population under study:</td>
<td>- Not reported</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td><strong>What was the study’s implementation setting?</strong></td>
<td>Community municipal state/provincial national international ecosystem Other, please specify: Not reported</td>
</tr>
<tr>
<td>Community level is smaller than the ecosystem, international, national, state/provincial, and municipal levels and refers to “a group of people with a common characteristic or interest living together within a larger society” (Merriam-Webster Online Dictionary 2008). Municipal level refers to “having a local self-government” (Merriam-Webster Online Dictionary) Ecosystem level refers to an ecosystem approach applied at a level that does not fall under any of the above geographical or hierarchical boundaries (e.g. a bay or forest).</td>
<td></td>
</tr>
</tbody>
</table>

**Methods**

<table>
<thead>
<tr>
<th>What study design/type was reported?</th>
<th>- Please specify: - Not reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>List any frameworks that were used or developed:</td>
<td>- Please specify: - Not reported</td>
</tr>
<tr>
<td>List the research methods used:</td>
<td>- Please specify: - Not reported</td>
</tr>
</tbody>
</table>
| What stakeholders were reported to be involved? | Government/policy maker  
Researcher (scientist/academic/government)  
Community members  
Community leaders/representatives/gatekeepers  
Local organizations (excluding businesses & health-related)  
Non-governmental organization (NGO)  
Industry/businesses  
External consultants  
Other, please specify:  
Not reported | | |
| --- | --- | --- |
| How were the stakeholders involved? | Defining/understanding the problem/research question(s)  
Designing interventions/research process  
Applying interventions/research process  
Assessing interventions/research process  
Other, please specify:  
Not reported | Stratify by stakeholder because different stakeholders may be involved in different activities. |
| List any evaluation methods that were used, if any: | - Please specify:  
- Not reported | |
| Outcomes | What outcomes are reported? | - Please specify:  
- Not reported | List qualitative and quantitative outcomes. |
| How were outcomes measured? | self-reported by participant(s) using a validated test  
Other, please specify:  
Not reported | |
| How were finding disseminated to stakeholders? | - Please specify:  
- Not reported | |
| Additional comments | ................................. | If the reviewer feels there is something that was not captured in the tool but should be acknowledged. |
References:


Appendix 2.6  Commentaries (n=24) analyzed using the analysis method framework and primary research articles (n=29) extracted using the data extraction tool

<table>
<thead>
<tr>
<th>Type of article</th>
<th>First Author</th>
<th>Title</th>
<th>Periodical</th>
<th>Year</th>
<th>Volume (Issue), Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cole, D. C.</td>
<td>Canada's International Development Research Centre's eco-health projects with Latin Americans: origins, development and challenges</td>
<td>Can J Public Health</td>
<td>2006</td>
<td>97(6), I8-14</td>
</tr>
<tr>
<td></td>
<td>Dakubo, C.</td>
<td>Economic Costs of Childhood Diseases and Disabilities Attributable to Environmental Health Planning in Ghana.</td>
<td>EcoHealth</td>
<td>2004</td>
<td>1(1), 50-59</td>
</tr>
<tr>
<td></td>
<td>Davies, K.</td>
<td>Contaminants in Washington State, USA. The paddy, the vector and the caregiver: lessons from an ecosystem approach to irrigation and malaria in</td>
<td>EcoHealth</td>
<td>2006</td>
<td>3(2), 86-94</td>
</tr>
<tr>
<td></td>
<td>De Plaen, R.</td>
<td>Northern Cote d'Ivoire</td>
<td>Acta Trop</td>
<td>2004</td>
<td>89(2), 135-46</td>
</tr>
<tr>
<td></td>
<td>Forget, G.</td>
<td>An ecosystem approach to human health</td>
<td>Int J Occup Environ Health</td>
<td>2001</td>
<td>7(S2), S3-38</td>
</tr>
<tr>
<td></td>
<td>Mutero, C.</td>
<td>A transdisciplinary perspective on the links between malaria and agroecosystems in Kenya</td>
<td>Acta Trop</td>
<td>2004</td>
<td>89(2), 171-86</td>
</tr>
<tr>
<td></td>
<td>Mutero, C. M.</td>
<td>Ecosystem approaches to human health</td>
<td>Cad Saude Publica</td>
<td>2001</td>
<td>S17(), 69-75</td>
</tr>
<tr>
<td></td>
<td>Nielsen, N. O.</td>
<td>Ecosystem approaches to human health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal</td>
<td>Volume</td>
<td>Issue</td>
<td>Pages</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------</td>
<td>--------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>Noronha, L.</td>
<td>Designing tools to track health and well-being in mining regions of India.</td>
<td>Natural Resources Forum</td>
<td>2001</td>
<td>25(1)</td>
<td>53-65</td>
</tr>
<tr>
<td>Rapport, D.</td>
<td>Environment Reporting Ecosystem Approach to Rapid Health Assessments among Indigenous Cultures in Degraded Tropical Rainforest Environments: Case Study of Unexplained</td>
<td>Ecol. indicators</td>
<td>2006</td>
<td>6(2)</td>
<td>409-428</td>
</tr>
<tr>
<td>Riach, J. R.</td>
<td>Deaths among the Secoya of Ecuador</td>
<td>Ecohealth</td>
<td>2004</td>
<td>1(1)</td>
<td>86-100</td>
</tr>
<tr>
<td>Silva, H.</td>
<td>An ecosystem approach to health and its applications to tropical and emerging diseases Use of the ecosystem approach to population health: the case of mercury contamination in aquatic environments and riparian populations, Andean Amazon, Napo River Valley, Ecuador</td>
<td>Cad Saude Publica</td>
<td>2001</td>
<td>S17</td>
<td>7-36</td>
</tr>
<tr>
<td>Spiegel, S.</td>
<td>Transdisciplinarity in EcoHealth: Status and Future Prospects.</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(4)</td>
<td>333-342</td>
</tr>
<tr>
<td>Waltner-Toews, D.</td>
<td>Critical linkages between land-use transition and human health in the Himalayan region The ecohealth system and the community engagement movement in foundations: A case study of mutual benefits from grants funded by the United Nations Foundation</td>
<td>Can J Public Health</td>
<td>2005</td>
<td>96(1)</td>
<td>44-6</td>
</tr>
<tr>
<td>Wilcox, B.</td>
<td>Environ Int</td>
<td>EcoHealth</td>
<td>2008</td>
<td>5(1)</td>
<td>1-3</td>
</tr>
<tr>
<td>Xu, J.</td>
<td>Natural resources forum</td>
<td>Natural resources forum</td>
<td>2004</td>
<td>28(2)</td>
<td>133-143</td>
</tr>
<tr>
<td>Primary research for data extraction (n=29)</td>
<td>Betancourt, O.</td>
<td>Small-scale Gold Mining in the Puyango River Basin, Southern Ecuador: A Study of Environmental Impacts and Human Exposures.</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(4), 323-332</td>
</tr>
<tr>
<td>Bunch, M. J.</td>
<td>Tsunami on an Ecohealth Project.</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(2), 150-154</td>
<td></td>
</tr>
<tr>
<td>Chimbari, M. J.</td>
<td>Opportunities for developing ecosystem based malaria control strategies in vlei irrigation schemes</td>
<td>World Resour. Rev.</td>
<td>2006</td>
<td>18(3), 431-449</td>
<td></td>
</tr>
<tr>
<td>Cifuentes, E.</td>
<td>Urban Sprawl, Water Insecurity, and Enteric Diseases in Children from Mexico City</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(1), 70-75</td>
<td></td>
</tr>
<tr>
<td>Dakubo, C.</td>
<td>Ecosystem Approach to Community Health Planning in Ghana.</td>
<td>EcoHealth</td>
<td>2004</td>
<td>1(1), 50-59</td>
<td></td>
</tr>
<tr>
<td>De Plaen, R.</td>
<td>The paddy, the vector and the caregiver: lessons from an ecosystem approach to irrigation and malaria in Northern Cote d’Ivoire</td>
<td>Acta Trop Alexandria Journal of Agricultural Research</td>
<td>2004</td>
<td>89(2), 135-46</td>
<td></td>
</tr>
<tr>
<td>Huebner, L. A.</td>
<td>The assessment and remediation of dysfunctional stress in medical school development and application of a framework for ecohealth research.</td>
<td>EcoHealth</td>
<td>2004</td>
<td>1(4), 374-386</td>
<td></td>
</tr>
<tr>
<td>Marko, J.</td>
<td>Analyzing the impacts of urban transportation. Network approach for analyzing and promoting equity in participatory ecohealth research.</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(2), 113-126</td>
<td></td>
</tr>
<tr>
<td>Author</td>
<td>Title</td>
<td>Journal/Conference</td>
<td>Year</td>
<td>Volume/Issue</td>
<td>Pages</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------------------------------------</td>
<td>---------------------------------------------------------</td>
<td>------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Murray, T. P.</td>
<td>Health, biodiversity, and natural resource use on the Amazon frontier:</td>
<td>Cad Saude Publica</td>
<td>2001</td>
<td>S17, 181-91</td>
<td></td>
</tr>
<tr>
<td></td>
<td>an ecosystem approach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutero, C. M.</td>
<td>A transdisciplinary perspective on the links between malaria and</td>
<td>Acta Trop</td>
<td>2004</td>
<td>89(2), 171-86</td>
<td></td>
</tr>
<tr>
<td></td>
<td>agroecosystems in Kenya</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interactions in Kathmandu, Nepal.</td>
<td>Environ Epidemiol</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noronha, L.</td>
<td>Designing tools to track health and well-being in mining regions of</td>
<td></td>
<td>2001</td>
<td>25(1), 53-65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>India</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passos, C. J.</td>
<td>Daily mercury intake in fish-eating populations in the Brazilian</td>
<td></td>
<td>2008</td>
<td>18(1), 76-87</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amazon</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ecosystem Approach to Rapid Health Assessments among Indigenous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cultures in Degraded Tropical Rainforest Environments: Case Study of</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unexplained Deaths among the Secoya of Ecuador</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Riach, J. R.</td>
<td>An integrated malaria control program with community participation</td>
<td>EcoHealth</td>
<td>2004</td>
<td>1(1), 86-100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>on the Pacific Coast of Colombia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rojas, W.</td>
<td>Chagas disease prevention through improved housing using an</td>
<td>Cad Saude Publica</td>
<td>2001</td>
<td>S17, 103-13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ecosystem approach to health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rojas-De-</td>
<td>Cultural encounters: learning from cross-disciplinary science and</td>
<td>Development in Practice</td>
<td>2007</td>
<td>17(2), 179-195</td>
<td></td>
</tr>
<tr>
<td>Arias, A.</td>
<td>development practice in ecosystem health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sherwood, S.</td>
<td>Biodiversity Conservation and Human Well-being: Challenges for the</td>
<td>EcoHealth</td>
<td>2005</td>
<td>2(4), 333-342</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Populations and Protected Areas of the Brazilian Atlantic Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>improve health in an inner-city Havana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spiegel, J.</td>
<td>Community participation in a multisectoral intervention to address</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>health determinants in an inner-city community in central Havana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yassi, A.</td>
<td>Community-based rice ecosystem management for suppressing vector</td>
<td>J Urban Health</td>
<td>2003</td>
<td>80(1), 61-80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>anopheles in Sri Lanka</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 3.1  Interview questions for post-doctoral fellow and project lead of the NCCR research team

Part 1: March 2010

Part 1 of the interview was conducted in English.

Stakeholder information

1. Describe your role as a stakeholder in this project.

   Probes:
   - What specific roles and responsibilities do you have in this project?
   - Is your relationship to this project more than just a researcher?
   - Is your relationship in the community more than just a researcher?

Understanding/defining the research problem

2. Describe how you came to an understanding of the research problem and the system under study.

   Probes:
   - What sources did you use to gather information?
   - Which stakeholder perspectives did you include?
   - Why did you use this information/perspective?
   - How did you get this information?
   - Are there any stakeholder perspectives that you think you should have include but didn’t?

Establishing the collaborations/partnerships

3. Describe how you identified the stakeholders in your research.

4. What was the nature of the collaborations?

   Probes:
   - What kind of relationship was developed?
   - What kind of support was offered?
   - What priorities were identified?
   - What was negotiated?
   - What objectives were agreed upon?
   - How was the collaboration maintained?
   - How did you decide who/which disciplines needed to be involved?
   - What were the desired outcomes and outputs?
Research planning

5. Who makes the decisions on how the research is conducted?

6. Who is consulted during the planning process?

Conducting the research

7. Who is involved in conducting the research at the ground level?

8. How are they involved?
   Probe: 
   - Describe the different types of participation.

Analyzing/interpreting results

9. Who is involved in analyzing and interpreting the results?

Results sharing

10. Who owns the data?

11. Is the data shared with other stakeholders?

12. Who are the data shared with specifically?

13. How are the data/results shared with each of the stakeholders?

Overall research process and approach

14. Discuss both successes and challenges that you experienced during the research process.

15. Were there delays in the process and if so, what do you think caused this?

16. Discuss integration throughout the research.

Probes:
- Who has been integrated?
- What are they integrating?
- Where does this integration happen?
- What is the purpose of integration?
- When does this integration happen during the research process?
- Describe how this integration happens.

17. What has been the outcome of this integration so far?

Part 2: April 2010

Part 2 of the interview was conducted in English.

Beneficiaries of the research

1. Who are the intended beneficiaries of this project?

2. How will these beneficiaries benefit from the project?

3. Has the research on environmental sanitation created more awareness of the problem among the different stakeholders compared with before the project started? How do you know this?

Objectives

“The overall goal of the NCCR North-South is to contribute to sustainable development through partnership research, capacity development and societal empowerment in developing and transition countries, while developing a formal institutional network between these countries and with Switzerland.” – Research Partnerships for Sustainable Development, Highlight of the NCCR North South Program in Southeast Asia 2005 -2009

4. How does the objective of each research project contribute to the overall objective of NCCR? In the past interview, you have already talked about doing research in partnership and capacity development at the research institution level, so can you elaborate on other ways that the research contributes to the overall objectives of NCCR?

Approach

5. Have you heard of ecohealth before you were introduced to my project?

6. What does it mean to you?

7. Does the research that the team has conducted demonstrate what you have described as ecohealth? How?

8. To your knowledge, do these concepts exist in the Vietnamese language?
9. In your opinion, would that make it easier to apply if these concepts could be explained in Vietnamese?


10. Do you consider this in designing the research? How?

11. Is there a common ground for the graduate student researchers to share their experiences and insights from your research with the other graduate student researchers?

12. Aside from the QMRA component of the research and the fact that the case study site and the problem of environmental sanitation, are there common links among the other graduate students’ projects?

13. What does participation mean to you? Do you think that is incorporated into the research?

14. Have you received any training in participatory methodologies? If so, which ones?

15. In your opinion, who should be responsible for designing, implementing, monitoring, and evaluating interventions?
Appendix 3.2 Interview questions for graduate students of the NCCR research team

Part 1: March 2010

Part 1 of the interview was conducted in English and used for the PhD student only.

1. Describe your role as a stakeholder in this project.

   Probes:
   - What specific roles and responsibilities do you have in this project?
   - Is your relationship to this project more than just a researcher?
   - Is your relationship in the community more than just a researcher?

2. I want to talk about how you interacted with members of the research team involved in other components of the health and environmental sanitation framework. By this, I am referring mainly to the other graduate students involved.

   Probes:
   - Did you consult them or share information from your research? Describe this in terms of the different stages of research (understanding/defining the research problem, establishing collaboration/partnerships, research planning, conducting the research, analyzing interpreting results, results sharing). What kind of information is shared? How is it shared? How often is it shared?
   - Did you have input in their research? Describe as in the previous question.
   - How does the team work together?
   - What was the purpose of this?
   - What was the outcome?
   - Have you come to a shared understanding of the problem? How was this done?

3. How did you decide on the objectives of your research?

   Probes:
   - Who did you consult?
   - Whose input did you use?
   - Were the objectives negotiated?

4. Do you share information with the other stakeholders in the research problem?
Probes:
- Who is the information shared with?
- What kind of information is shared?
- How is it shared?
- How often is it shared?

5. Have the other stakeholders shared with you their priorities?

Probes:
- Please speak about the research institutions, local institutions, and community members. By community members, I mean the interview participants, mainly farmers.

6. If yes, what are these priorities?

7. Do the stakeholders have a common understanding of the problem?

Probes:
- How was this achieved?
- What tools or methods were used?
- Who was involved?

8. Does research address how different groups in the community may be affected by the research problem differently?

Probes:
- How does the research address this?

9. Discuss both successes and challenges that you experienced during the research process.

10. Were there delays in the process and if so, what do you think caused this?

11. What contribution has your research made to the community?

Probes:
- Please speak about the local institutions and community members.

**Part 2: April 2010**

Part 2 of the interview was conducted in Vietnamese and used for both the PhD and MSc students.
Beneficiaries/Người hướng lợi

1. Who are the intended beneficiaries of this project? Ai là người hướng lợi theo mục đích của dự án này?

2. How will these beneficiaries benefit from the project? Những người này hướng lợi từ dự án như thế nào?

3. Has the NCCR research on environmental sanitation created more awareness of the problem among the different stakeholders compared with before the project started? How do you know this? Nghiên cứu của NCCR về điều kiện về sinh môi trường này có đưa lại thêm nhận thức về vấn đề cho những bên liên quan khác nhau so với trước lúc dự án bắt đầu không? Anh/chị biết điều này bằng cách nào?

Objectives/Mục tiêu

“The overall goal of the NCCR North-South is to contribute to sustainable development through partnership research, capacity development and societal empowerment in developing and transition countries, while developing a formal institutional network between these countries and with Switzerland.” – Research Partnerships for Sustainable Development, Highlight of the NCCR North South Program in Southeast Asia 2005 -2009

“Mục tiêu tổng thể của NCCR Bắc-Nam là góp phần vào sự phát triển bền vững thông qua nghiên cứu hợp tác, phát triển năng lực và trao quyền xã hội ở các nước đang phát triển và chuyển tiếp, trong khi phát triển mạng lưới thiết lập chính thức giữa những nước này và với Thụy Sỹ” – Hợp Tác Nghiên Cứu với Phát triển bền vững, Phần kết yếu trong chương trình NCCR Bắc Nam ở Đông Nam Á 2005-2009

4. How does the objective of each research project contribute to the overall objective of NCCR?

Probe:
- Please focus on the community stakeholders in your response. Mục tiêu của từng dự án nghiên cứu đóng góp vào mục tiêu tổng thể của NCCR như thế nào? Hãy tập trung vào những bên liên quan tại cộng đồng trong câu trả lời của anh/chị.

Approach/Tiếp cận
5. Have you heard of ecohealth before you were introduced to my project? 
   Anh/chị đã nghe về “ecohealth” trước khi anh/chị được giới thiệu về dự án của tôi chưa?

6. What does it mean to you? Theo bạn, nó có nghĩa là gì?

7. Does the research that the team has conducted demonstrate what you have
described as ecohealth? How? Nghiên cứu mà nhóm đã thực hiện có minh hoa được những gì bạn vừa mô tả giống như “ecohealth” không? Như thế nào?

8. To your knowledge, do these concepts exist in the Vietnamese language? 
   Với kiến thức của bạn, những khái niệm này có tồn tại trong tiếng Việt không?

9. In your opinion, would that make it easier to apply in research practice if 
   these concepts could be explained in Vietnamese? Theo bạn, điều này có được áp dụng dễ dàng hơn trong thực hành nghiên cứu nếu những khái niệm này có thể giải thích bằng tiếng Việt?

10. Aside from the QMRA and epidemiology component of the research and the 
    fact that the case study site and the problem of environmental sanitation are 
    common links among the other graduate students’ projects of NCCR in 
    Vietnam, are there any other links between your project and theirs? Ngoài các thành phần QMRA và dịch tễ của nghiên cứu và thực tế là địa điểm thực hiện nghiên cứu với vấn đề về vệ sinh môi trường có những liên hệ chung giữa các dự án của những nghiên cứu sinh NCCR ở Việt Nam, có những sự liên hệ nào khác giữa dự án của bạn và của họ?

11. What does participation in your research mean to you? Do you think that is 
    incorporated into the research? Theo anh/chị, sự tham gia nghiên cứu có nghĩa là gì? Anh/chị nghĩ điều này có kết hợp chặt chẽ trong nghiên cứu của anh không?

12. Have you received any training in participatory methodologies? If so, which 
    ones and how have they helped you in your research? Bạn có bao giờ được 
    tập huấn hoặc được học phương pháp luận về tham gia chưa? Nếu có, đó là những gì và chúng giúp ích cho bạn trong nghiên cứu như thế nào?
13. In your opinion, who should be responsible for designing, implementing, monitoring, and evaluating interventions? Why? Theo bạn, ai nên chịu trách nhiệm thiết kế, thực hiện, giám sát và đánh giá sự can thiệp? Tại sao?
Appendix 3.3  Interview questions for the Head of Health Station and health staff workers in Nhat Tan and Hoang Tay Communes

The interviews were conducted in Vietnamese.

Information about the respondent – Thông tin người trả lời

1. Which district, commune, and village do you live in? – Anh sống ở thôn, xã, huyện nào?

2. Do you have authority or any influence over the type of health programs that are delivered through the Health Station? If so, do you have authority over how they are implemented? – Anh có quyền hành hay ảnh hưởng đến các chương trình sức khỏe được phân phối đến Trạm y tế không? Nếu có, anh có thẩm quyền về cách thực hiện những chương trình đó không?

Participation in the research – Sự tham gia trong dự án

3. Please describe your role in the NCCR research on environmental sanitation. – Anh hãy mô tả vai trò của mình trong nghiên cứu của NCCR về vệ sinh môi trường.

4. How do you feel about the research that NCCR team is doing? – Anh cảm thấy như thế nào về nghiên cứu của nhóm NCCR đang làm?

5. How would you describe your relationship with the researchers? – Anh mô tả mối quan hệ của mình với những người nghiên cứu này như thế nào?

6. How would describe your relationship with the community members? – Anh mô tả mối quan hệ của mình với người dân trong công động như thế nào?

7. Has the NCCR research project on environmental sanitation changed your awareness of the issue? How? – Dự án nghiên cứu của NCCR có đã thay đổi nhận thức của anh về vấn đề về vệ sinh môi trường này không? Như thế nào?

8. Did the any of the NCCR researchers ask for your input for how the research should conducted? If so, who asked you specifically? If so, what suggestions did you give them? – Đã có nghiên cứu viên nào của NCCR tham khảo thêm ý kiến của anh về cách tiến hành nghiên cứu không? Cụ thể là ai hỏi? Nếu có, anh đã đưa ra những đề nghị nào?

9. If they did not ask for your input or they did not incorporate it into their research, is there anything that you would have liked to contribute in terms
of knowledge, skills, or responsibilities? – Nếu họ không hỏi tham khảo thêm ý kiến của anh hoặc không hợp tác chặt chẽ trong nghiên cứu, anh đã có điều gì muốn đóng góp về kiến thức, kỹ năng hoặc vai trò trách nhiệm không?

10. Did they discuss their priorities and objectives with you? (what are they?) Were they open to you expressing your priorities and objectives? What are the issues that you would like addressed through research besides what they proposed to do in their research? – Họ có thảo luận về mục tiêu và ưu tiên của họ với anh không? Anh có cam thay thảo mai khi nói về những ưu tiên và mục tiêu của mình với người ta không? Những vấn đề nào anh muốn chia sẻ thông qua nghiên cứu, ngoài những điều họ đề xuất làm trong nghiên cứu của họ?

11. As far as you know, what are issues are important to the community members? Are there any other issues other than those related to health and environmental sanitation? – Theo hiểu biết của anh, những vấn đề nào quan trọng với người dân cộng đồng? Có những vấn đề nào khác ngoài những vấn đề liên quan đến sức khỏe và vệ sinh môi trường không?

12. Has the dialogue increased between you and the other stakeholders, aside from the researchers, as a result of your participation in this research? – Ngoài các nghiên cứu viên, sự đối thoại giữa anh và những người liên quan khác có tăng nhiều lên sau khi anh tham gia vào nghiên cứu không?

13. Have you learned anything new in terms of knowledge and skills as a result of your participation in this research? – Anh có học hỏi thêm được điều gì mới về kiến thức và kỹ năng sau khi tham gia vào nghiên cứu này không?

Results Sharing – Chia sẻ kết quả

14. Do you think the results of this research are useful for your work and your community? If so, how can you use these results? – Anh nghĩ kết quả nghiên cứu này có hữu ích cho công việc của anh và cộng đồng này không? Nếu có, anh (trảm y te) có thể sử dụng những kết quả đó như thế nào?

15. What could the researchers do to help you understand their results better or make them more useful for you? – Nghiên cứu viên có thể làm gì để giúp anh hiểu kết quả đó tốt hơn hoặc khiến chúng hữu ích hơn cho anh? Cho cộng đồng?

16. Will you be sharing these results with community members? If so, what means will you use to share this information? – Anh có sẽ chia sẻ những
17. In the past, when researchers conduct research in your community, do they normally come back to present results and give you a copy of the results? – Trước đây, khi người ta thực hiện nghiên cứu ở cộng đồng, người ta có thường trở lại để trình bày kết quả và cung cấp cho anh bản kết quả không?

Using research results – Sử dụng kết quả nghiên cứu

18. Based on what has been done so far in the research, do you have any suggestions for the researchers to help them improve their approach? – Dựa trên những gì đã thực hiện trong nghiên cứu, anh có đề nghị nào cho nghiên cứu viên để giúp họ cải thiện cách tiếp cận không?

19. Who do you think is responsible for designing, implementing, monitoring, and evaluating interventions to improve the problem of environmental sanitation? – Anh nghĩ ai là người chịu trách nhiệm cho việc thiết kế, thực hiện, giám sát và đánh giá việc can thiệp để cải thiện vấn đề vệ sinh môi trường?

20. What do you hope will be the outcome of this research? – Anh hy vọng kết quả gì từ nghiên cứu này?

21. In your opinion, who owns the data from this research? – Theo anh, ai nên sở hữu số liệu từ nghiên cứu này?

22. In your opinion, who are the chief beneficiaries of this research on environmental sanitation? How do you think they will benefit? – Theo anh, ai là người hưởng lợi chính từ nghiên cứu về vệ sinh môi trường này? Anh nghĩ người ta hưởng lợi như thế nào?

23. In your opinion, do you think that simply providing information and educating the community members on the issues of environmental sanitation will result in behavioural change? If not, what else do you think is needed? – Theo anh, anh có nghĩ chỉ đơn giản cung cấp thông tin và giáo dục người dân cộng đồng về vấn đề về sinh môi trường sẽ dẫn đến kết quả của việc thay đổi hành vi không? Nếu không, anh nghĩ con cần dieu gì khác nữa?

1 Instead of question 2 above, the following questions were asked of the health staff workers:
Describe your responsibilities as a health worker/health staff. – *Chi co the mo ta cong viec lam nhan vien y te thon cua chi duoc khong?*

How long have you been working as a health worker/health staff? *Chi lam viec nhan vien y te bao lau roi?*
Appendix 3.4  Focus group questions for community members and village health workers in Nhat Tan and Hoang Tay Communes

The focus group discussions were conducted in Vietnamese. Each section of questions was given approximately 10 minutes.

Introductions

We are going to start with introductions. As we go around the group, please tell us your name. We would like you to tell us a little bit more about yourself, so you can tell us which village you live in, what your occupation is (including whether or not you are a village health worker), and one interesting point you would like to share about yourself. Please keep the introductions brief.

As you have read in the introduction letter when you arrived, we are interested in evaluating the approach that the researchers from the National Institute of Hygiene and Epidemiology are using to study the issue of health and environmental sanitation in your commune. You were invited here today because you have participated in their research and we would like to hear your opinions.

1. How have you been involved in the research so far? Các chi đã tham gia vào nghiên cứu này như thế nào?

Probes: Thăm dò them
- What did you do? Các chi đã làm gì?
- How often? Bao lâu một lần?
- With whom did you meet? Các chi đã gặp ai?
- Why did you choose to participate? Tại sao các chi quyết định tham gia?

2. What do you think of the topic of research, health and environmental sanitation? Các chi nghĩ gì về đề tài nghiên cứu – sức khỏe và vệ sinh môi trường?

Probes: Thăm dò them
- Do you think this topic is important? Why or why not? Các chi có nghĩ đề tài này quan trọng không? Tại sao?
- What do you think the specific problems are regarding health and environmental sanitation? Các chi nghĩ những vấn đề cụ thể về sức khỏe và vệ sinh môi trường là gì?
- What do you think is the cause of the problem? Các chi nghĩ nguyên nhân của vấn đề đó là gì?
- What kind of toilet do you have? Nhà vệ sinh của gia đình chi là loại gì?
- How do you think poor environmental sanitation affects your health? Các chi nghĩ điều kiện vệ sinh môi trường kém thay ảnh hưởng đến sức khỏe của các chi như thế nào?
- Who do you think should be responsible for improving it through interventions? Tại sao?
- Would you want to be involved in designing, implementing, monitoring, or assessing interventions? Tại sao?
- If yes, how do you think you could be involved? Nếu có, các chi nghĩ mình sẽ tham gia như thế nào?
- What would an ideal solution look like? Giải pháp lý tưởng sẽ như thế nào?
- What would you measure? Các chi sẽ đánh giá/đo (bằng) điều gì?
- How would you know that an improvement in environmental sanitation was made? Các chi đồng vai trò gì trong vấn đề về sức khỏe và vệ sinh môi trường trên chuyến vi là thành viên cộng đồng?
- If you could meet with the people who you think are responsible for interventions, would you feel comfortable discussing the issue with them? Nếu các chi có thể gặp người mà các chi nghĩ là chịu trách nhiệm về vấn đề cần thiết, các chi có tham gia xử lý vấn đề này với họ không? Tại sao? Nếu cả thúc đẩy, các chi sẽ nói gì với họ?
- If your income was increased, would that help the problem? Như thế nào?
3. What do you think of the researchers’ approach to doing research with you, the community? By researcher’s, we mean both the NIHE researchers and the health station workers. You can address them separately in your responses. Các chỉ nghĩ gì về cách tiếp cận của nhóm nghiên cứu khi làm nghiên cứu với chi, với cộng đồng? Nhóm nghiên cứu mà chúng tôi nói ở đây là những nghiên cứu viên của Viện Vệ sinh Dịch Tể Trung Ương và nhân viên trạm y tế.

Probes: Thăm dò thêm
- What did you like or dislike? Các chỉ thích hoặc không thích điều gì?
- What do you feel should have been done differently? Các chỉ thấy điều gì nên được thực hiện khác đi?
- Do you have any suggestions for the researchers to improve their approach? Các chỉ có góp ý gì để nhóm nghiên cứu cải thiện cách tiếp cận của họ?
- Did you feel comfortable expressing your opinions, suggestions, or thoughts on the research to the research team members? Các chỉ có cảm thấy thoải mái để bày tỏ ý kiến, đồng góp hoặc suy nghĩ về nghiên cứu với các thành viên nhóm nghiên cứu không?
- Have they returned and share any results with you? Họ có quay trở lại và chia sẻ kết quả gì với các chỉ không?
- Have they returned to have discussions on what the next steps for the community might be? Họ có quay trở lại để thảo luận với các chỉ về những bước tiếp theo cho cộng đồng không?
- Do you have more interaction with them as a result of the research? Các chỉ có nhiều sự tương tác/ trao đổi hơn với họ sau khi tham gia vào nghiên cứu này không?
- What resources do you think you would need to tackle solutions as a community? Các chỉ nghĩ sẽ cần những nguồn lực/ sự hỗ trợ nào để thực hiện các giải pháp ở cộng đồng?

4. What issues are important to you in the community? Đối với các chỉ, những vấn đề nào là quan trọng ở cộng đồng?

Probes: Thăm dò thêm
- Issues related to health and environmental sanitation? Những vấn đề liên quan đến sức khỏe và vệ sinh môi trường?
- Other issues aside from health and environmental sanitation? Những vấn đề khác ngoài sức khỏe và vệ sinh môi trường?
- Do you voice these concerns? Các chỉ có nói lên những băn khoăn này không?
- If yes, to whom do you voice these to? Nếu có, các chỉ bày tỏ những băn khoăn này với ai?
- If no, what prevents you from voicing these concerns? Nếu không, có điều gì gây trở ngại cho việc các chi bày tỏ những băn khoăn này?

This is the final topic for discussion. Đây là chủ đề cuối cùng của buổi thảo luận.

5. Have you learned anything from the research? Các chi có học hỏi được điều gì từ nghiên cứu này không?

Probes: Thăm dò thêm
- What skills or knowledge have you learned through your participation in the research? Các chi đã học được kỹ năng hoặc kiến thức nào thông qua sự tham gia vào nghiên cứu?
- What skills or knowledge have you learned through the household visits? Các chi học được kỹ năng và kiến thức nào qua những chuyến đi thăm các hộ gia đình?
- Has your awareness or knowledge changed compared with before the research project started? How? So với trước lúc dự án nghiên cứu bắt đầu, kiến thức hoặc nhận thức của các chi có thay đổi không? Thay đổi như thế nào?
- Have you shared what you have learned with other community members that did not participate in the research? Các chi có chia sẻ những gì mình học được với những thành viên khác trong cộng đồng – những người không tham gia vào nghiên cứu?

After the final topic, ask the participants if they want to added anything that they didn’t get a chance to say.

Probes for passive participants (Spencer, Ritchie, & O'Connor, 2003)
After probing for an individual’s comment, open the discussion out the group by asking:
- How do other people feel? What does everyone else think?
- Repeat the question for the group.
- Highlight a participant’s comment, then asking for people’s thoughts on it.
- Asking the group: Can you say a bit more on that?
- Physically looking around and gesturing the rest of the group to contribute.
- Maintain the silence so that the group has time to think about the question more.
- Highlighting differences in views and encourage the group to explain and discuss them.
- Everyone is nodding – why is that?
- Everyone is quiet. Why is this subject hard to talk about?
- For dominant participants: Your opinions are useful, but we want to hear from others as well.
- Make eye contact with passive participants. Ask them what they think.
- Ask them for their personal opinion if they are expressing the opinion of another person or group.
Appendix 3.5

Information letter and consent form for research participants
(English version)

Dear participant,

The purpose of this letter is to provide you with information regarding our research study, titled: Identifying the impediments and enablers of ecosystem approaches to health (ecohealth) for a case study of health, environmental sanitation, and the socioeconomic environment in Hanam, Vietnam. The research will be carried out by Vi Nguyen, BSc. Tech. from the University of Guelph, Canada.

This study is a mid-term evaluation of how well the case study application of a new conceptual framework on health and environmental sanitation in Vietnam fits the concepts of ecohealth. The case study has been implemented within a collaboration between the Swiss Tropical Institute (STI), Hanoi School of Public Health (HSPH), and National Institute of Hygiene and Epidemiology (NIHE). Ecohealth is a newly evolved concept, compared with other conventional approaches and we would like to use it to make recommendations for the continuation of the case study, as well as offer lessons from this study to help build capacity in the application of ecohealth in South East Asia. Your participation will help facilitate this and give you an opportunity to raise some of your own concerns regarding the research.

This research is supported by the Canadian Community of Practice in Ecosystem Approaches to Health (CoPEH-Can) and through a partnership between the University of Guelph (U of G), HSPH, NIHE, and STI.

Participation in this research is voluntary. It involves an in-person interview with the student investigator (in English) or research assistant (in Vietnamese) for 20-40 minutes. We will be interviewing the research team members, the local government stakeholders, and the community stakeholders that were involved in the implementation of the case study. It is likely that at least three occasions is required with the research stakeholders and one or two occasions is required of the local government and community stakeholders.

Questions to be asked during the interview will depend on the role of stakeholder in the case study. An example of a question for a research stakeholder is: what discipline is your component of the research from for the current case study? An example of a question for a local government stakeholder is: do any mechanisms
exist for formal institutions to foster a dialogue with community members? An example of a question for a community stakeholder is: what are your concerns regarding health and environmental sanitation?

Please be advised that this interview will be tape-recorded and that we may use your verbatim quotations in the research results. You may decline to answer questions that you are not comfortable with. Please don’t hesitate to ask the interviewer to clarify questions if you do not understand. You may withdraw your agreement to participate at any time during the study and have your data withdrawn without consequence.

We do not anticipate that your participation in this study will cause you any risks greater than what you encounter on a daily basis. We cannot guarantee confidentiality or anonymity of your responses because the results need to be shared with the research team and your role as a stakeholder may identify you as a participant in this research. The data will be stored until December 2010, when the research and reports for this project are likely to be completed by, and it will be stored on a password-protected computer.

Any plans for follow-up will happen at a later date if necessary and we will contact you by phone. The research findings will be made available to all participants through a final report following the completion of the research. The student investigator will also make a seminar presentation at the HSPH, where the research stakeholders will be invited.

This project has been reviewed and received ethics clearance through the U of G and HSPH Research Ethics Board. If you have questions regarding the use and safety of human subjects in this research project, you may contact Sandy Auld, U of G Research Ethics Coordinator, +1-519-824-4120, ext. 56606, reb@uoguelph.ca

Thank you in advanced for your interest and participation in this study.
Participant Informed Consent Form

I understand the details presented in the letter titled: Information letter for participants of the ecohealth case study evaluation in Vietnam. I have had the opportunity to ask questions regarding the study, which were answered to my satisfaction. I understand that confidentiality and anonymity cannot be guaranteed, due to the purpose of the study. I am aware that my participation in the study is voluntary and that I can withdraw at any time with no consequence. If I decide to withdraw, I will contact the student investigator, whose contact information is given in the information letter. I have received a copy of the information letter mentioned above, as well as this consent form.

My signature below indicates that I am willing to participate in this study.

Printed name of participant: Date:

Signature of participant: Date:

Printed name of interviewer: Date:

Signature of interviewer: Date:
Appendix 3.6  Information letter and consent form for research participants (Vietnamese version)

Xác định những trí ngai và khả năng áp dụng cách tiếp cận sức khỏe hệ sinh thái (goi tắt là "sức khỏe hệ sinh thái") trong nghiên cứu về sức khỏe, vệ sinh môi trường và kinh tế xã hội tại Hà Nam, Việt Nam

Kính gửi các anh chị tham gia,

Đây là một nghiên cứu giữa kỳ để đánh giá nghiên cứu trường hợp về sự áp dụng của những lý thuyết về sức khỏe và vệ sinh môi trường ở Việt Nam phù hợp như thế nào với cách tiếp cận sức khỏe hệ sinh thái. Nghiên cứu trường hợp này được thực hiện bởi Viên Nhịệt đổi Thủy Sĩ (STI), Trường Đại học Y tế Công cộng và Viên Vệ sinh Dịch tỵ trung ương (NIHE). So với các cách tiếp cận thông thường thì "sức khỏe hệ sinh thái là một khái niệm mới được phát triển, chúng tôi muốn sử dụng phương pháp này để dựa ra các khuyến nghị cho việc tiếp tục thực hiện nghiên cứu trường hợp cũng như rút ra những bài học kinh nghiệm để giúp xây dựng năng lực trong việc áp dụng sinh thái học sức khỏe tại Đông Nam Á. Sự tham gia của bạn sẽ giúp chúng tôi thực hiện nghiên cứu này thuận tiện hơn cũng như tạo cho bạn những cơ hội dựa ra những mối quan tâm của bạn thân bạn về nghiên cứu này.

Nghiên cứu này được hỗ trợ bởi Công động Thực hành sinh thái học sức khỏe Ca Na Da (CoPEH-Can) và được thực hiện bởi Nguyễn Cao Thùy Vi, học viên cao học trường Đại học Guelph. Những người tham gia vào nghiên cứu này hoàn toàn tự nguyện. Việc nghiên cứu sẽ bao gồm phỏng vấn, nghiên cứu trường hợp và can bộ trợ lý nghiên cứu trong vòng một tháng với các đối tượng được phỏng vấn. Khi tiến hành nghiên cứu này chúng tôi sẽ tiến hành phỏng vấn với các thành viên trong nhóm nghiên cứu, các bên ngành địa phương và trong cộng đồng.

Xin lưu ý rằng, cuộc phỏng vấn sẽ được ghi âm và có thể được sử dụng nguyên bản để trích dẫn trong kết quả nghiên cứu. Bạn có thể từ chối trả lời những câu hỏi mà bạn cho rằng không thiết yếu trong việc.

Các câu trả lời cũng như các kết quả thu được từ anh/chị sẽ được chia sẻ với những thành viên trong nhóm nghiên cứu và vai trò như một đối tác bạn có thể được nhận ra khi tham gia vào nghiên cứu này.

Dự án này đã được xem xét và nhận được sự thông qua về mất đạo đức từ trường Đại học Guelph, Canada và hội đồng đạo đức trường Đại học Y tế Công cộng Hà Nội. Nếu như bạn có bất kỳ câu hỏi nào liên quan tới nghiên cứu này, vui lòng liên hệ với Nguyễn Cao Thùy Vi, số điện thoại 01263009306.

Cảm ơn anh chị đã quan tâm và tham gia nghiên cứu này.
Đơn chấp nhận tham gia nghiên cứu

Tôi hoàn toàn hiểu những thông tin trong thu môi tham gia nghiên cứu này. Tôi đã có cơ hội được đặt những câu hỏi có liên quan tới nghiên cứu và tôi thấy hài lòng với các câu hỏi đó. Tôi hiểu các thông tin mà tôi cung cấp sẽ được chia sẻ với mục đích của nghiên cứu. Tôi nhận thức được rằng sự tham gia của tôi trong nghiên cứu này là hoàn toàn tự nguyện và tôi có thể rút lui bất kỳ lúc nào và không có bất kỳ ảnh hưởng/hậu quả nào. Nếu tôi đồng ý rút lui, tôi sẽ liên hệ với tram y tế xã nơi tôi đang sinh sống và sau đó tram y tế sẽ thông báo cho trưởng nhóm nghiên cứu là Tiến sĩ Nguyễn Việt Hùng.

Chữ ký của tôi chứng tỏ tôi chấp nhận tham gia vào nghiên cứu này.

Tên đối tượng tham gia nghiên cứu: Ngày tháng 5 năm 2010
Ký nhận tham gia đồng ý: Ngày tháng 5 năm 2010
Tên người phản văn: Ngày tháng 5 năm 2010
Chữ ký người phản văn: Ngày tháng 5 năm 2010

Phòng văn: Thành viên cộng đồng

Tên người được phản văn______________________________ Giới tính: Nam/Nữ  Tuổi______
Tên điều tra viên ________________________________
Tháng_____/ Ngày_____ / Năm ____  Thời gian phản văn: _____:_____ - _____:_____
Địa điểm  Thành phố/Tỉnh : ________________________________________________________________
Quận/Huyện ___________________________  Phường/Xã ___________________________
Tổ dân phố_________________________ Số nhà: ______________
Appendix 3.7 Analysis Method Framework

The objective of this tool is to extract explanations of ecosystem approaches in a public health context using a framework approach for qualitative analysis.

1. Identifying initial themes or concepts
   - Become familiar with the data by reading 10 articles and write analytic memos on each (1). Analytic memos are like journal entries about the researchers thoughts on the data, the coding process, and patterns that emerge from the data (Pg 32, 33). Date each memo to keep track of the progression of the study (Pg 33). Circle or highlight passages that appear noteworthy (Pg 16).
   - Things to reflect on and write about: how you relate to the data, the research question, codes and their definitions, patterns, categories, themes, and concepts that emerge and how they are related, emergent or related existing theory, problems and/or personal or ethical dilemmas you are having relating to the study, your vision for future directions, the memos already written, or the final report for your study (Pg 34 - 39) (1)
   - Create a list of recurring themes or ideas, but also include topics that come up which are related to the research question (2). When reading, keep in mind some guiding questions: What definition or explanation of ecosystem approaches is given? How is this related to public health? The themes should be grounded in the data (i.e. It uses the language found in the data or at least stays very close to it)
   - Construct a thematic framework by sorting the themes under broader categories. This is a working framework, which can be altered as the analysis progresses.

2. Labelling or tagging data by concept or theme
   - Apply the framework to the data by reading the text in detail and asking oneself “what is this about?” Label directly on the document. Make note of interconnections between themes by looking at interspersion of themes within the data.
   - Identified themes that are not already part of the framework can be added and categories can be broken down or combined, depending on whether the data fits existing categories. If the framework is changed, go back and check that indexing has been applied consistently. Document revisions made to the framework.

3. Sorting data by theme or concept
   - Sort the data in thematic charts like in the example below. Interconnected or closely related themes should be displayed together on one chart; otherwise the themes should be displayed in separate charts. Keep each ref
id on the same row of every chart to allow comparison between ref ids and themes.

<table>
<thead>
<tr>
<th>Identifier (document/ref id)</th>
<th>Main theme:</th>
<th>Memos/notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-theme 1</td>
<td>Sub-theme 2</td>
<td>Include emergent themes and ideas to consider</td>
</tr>
<tr>
<td>Ref id 1, author, year, journal</td>
<td>Page #, paragraph # - Data</td>
<td></td>
</tr>
</tbody>
</table>

4. Summarizing and synthesizing data
- Summarize by only including data that captures the content and context of what is being said.
- Work through the data systematically. Either summarize by theme for all documents or by document for all themes. Use the same kind of table as in Step 3.

5. Identifying elements and dimensions, refining categories, classifying data
- Work with each theme separately by reading the data in a column across cases. On a separate sheet, identify elements/dimensions in the data (Column B). Label the data to suggest what the data represents (Column C). At this stage, you are going from the original data to descriptive categories and this is where interpretation starts to occur. Be critical during categorization by asking yourself: is this a new category or a component of one already identified? Once the chart is filled out, make a list of the categories. Consider grouping categories that present similar concepts into the same broader category.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
<th>Column C</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summarized data from sub-theme 1</td>
<td>Elements/dimensions identified from the data</td>
<td>Category</td>
<td>Include commonalities among categories</td>
</tr>
<tr>
<td>Ref id 1, author, year, journal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. Establishing typologies
- A typology is a systematic classification of types. Typologies tend to be multidimensional classifications, which have discrete and independent categories.
- Depending on what earlier steps in the analysis reveal, we may or may not create typologies because typologies are not always suitable or necessary for all qualitative studies. They are only useful if they help explain differences.
7. Detecting patterns (associative analysis and identification of clustering)
   - To detect patterns of association, start by searching within cases (documents) first and then across cases individually. Look for linkages between sets of phenomena and for repetition of these linkages. Note contradictory associations as well. Even if there is no explanatory connection, note co-existence of phenomena. This kind of search is done with the whole dataset.
   - Make a summary table of these patterns
   - If typologies have been established, we can look for any characteristics that are attached within certain groups.
   - Verifying associations involves examining the number of times a particular phenomenon is associated with another. One can also check by searching for or developing explanations, as explained in the next step.

8. Developing explanations (answering how and why questions)
   - Give explicit reasons by using the repetition, range and variety of explanations offered in the document or give explanations for patterns that occur with explicit reasons.
   - Make inferences by searching for evidence that is not immediately visible using one or more of these approaches: 1) comparing unconnected themes side by side or just use their interspersion 2) repeated coexistence of phenomena, not necessarily in proximity. 3) looking at the differences between the presence and absence of phenomenon among documents.
   - Use common sense to find explanations by checking if assumptions either fit a commonly existing pattern or can just be seen in the data but this kind of reasoning must be evident across the whole data set.
   - A strong analytical concept which is developed during the study or analysis can itself serve as an explanation.
   - Established theoretical concepts may be useful for explaining the findings (2).

References: