Open Research Online

The Open University's repository of research publications
and other research outputs

Mapping environmental sustainability: Reflecting on systemic practices for participatory research

Edited Book

How to cite:

Oreszczyn, Sue and Lane, Andy eds. (2017). Mapping environmental sustainability: Reflecting on systemic practices for participatory research. Bristol: Policy Press.

For guidance on citations see FAQs.

© [not recorded]

https://creativecommons.org/licenses/by-nc-nd/4.0/

Version: Publication Extract

Link(s) to article on publisher's website:
http://dx.doi.org/doi:10.2307/j.ctt22p7kpb
https://policypress.co.uk/mapping-environmental-sustainability

Copyright and Moral Rights for the articles on this site are retained by the individual authors and/or other copyright owners. For more information on Open Research Online's data policy on reuse of materials please consult the policies page.

oro.open.ac.uk

MAPPING ENVIRONMENTAL SUSTAINABILITY

Reflecting on systemic practices for participatory research

Edited by Sue Oreszczyn and Andy Lane

First published in Great Britain in 2017 by

Policy Press
University of Bristol
1-9 Old Park Hill
Bristol
BS2 8BB
UK
t: +44 (0)117 954 5940
pp-info@bristol.ac.uk
www.policypress.co.uk

North America office:
Policy Press
c/o The University of Chicago Press
1427 East 60th Street
Chicago, IL 60637, USA
t: +1 773 702 7700
f: +1 773-702-9756
sales@press.uchicago.edu
www.press.uchicago.edu

© Policy Press 2017

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record for this book has been requested

ISBN 978-1-4473-3157-5 hardcover
ISBN 978-1-4473-3531-3 ePub
ISBN 978-1-4473-3532-0 Mobi
ISBN 978-1-4473-3158-2 ePdf

The rights of Sue Oreszczyn and Andy Lane to be identified as editors of this work has been asserted by them in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved: no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise without the prior permission of Policy Press.

The statements and opinions contained within this publication are solely those of the editors and contributors and not of the University of Bristol or Policy Press. The University of Bristol and Policy Press disclaim responsibility for any injury to persons or property resulting from any material published in this publication.

Policy Press works to counter discrimination on grounds of gender, race, disability, age and sexuality.

Cover design by Hayes Design
Front cover image: Getty
Printed and bound in Great Britain by TJ International, Padstow
Policy Press uses environmentally responsible print partners

We dedicate this book to the many people involved in all the projects featured in this book. Our research participants, partners and colleagues. It was their enthusiasm and generosity with their time that made our research possible.

Contents

List of figures, tables and boxes		vii
List of acronyms		ix
Notes on contributors		xi
one	Introduction *Sue Oreszczyn and Andy Lane*	1
two	Systems thinking in practice: mapping complexity *Andy Lane and Martin Reynolds*	17
three	Researching agri-environmental problems with others *Sue Oreszczyn, Les Levidow and Dave Wield*	45
four	Mapping agri-environmental knowledge systems *Sue Oreszczyn and Andy Lane*	75
five	Using visual approaches with Indigenous communities *Andrea Berardi, Jay Mistry, Lakeram Haynes, Deirdre Jafferally, Elisa Bignante, Grace Albert, Rebecca Xavier, Ryan Benjamin and Géraud de Ville*	103
six	Mapping muck: stakeholders' views on organic waste *Andy Lane, Rachel Slater and Sue Oreszczyn*	129
seven	Understanding and developing communities of practice through diagramming *Chris Blackmore, Natalie Foster, Kevin Collins and Ray Ison*	155
eight	'Imagine': mapping sustainability indicators *Simon Bell*	183
nine	Evaluating diagramming as praxis *Martin Reynolds*	205
ten	Conclusions *Andy Lane and Sue Oreszczyn*	229
Index		241

List of figures, tables and boxes

List of figures

1.1 The relationship between the researcher and the system of interest 8
2.1 A systems map of (a) the human body and (b) the systems movement 25
2.2 Influences that have shaped contemporary systems approaches and the lineages from which they have emerged 27
2.3 Example of a spray diagram 32
2.4 Example of an influence diagram 34
2.5 Example of a causal loop diagram 34
3.1 Example of a company's cognitive map from the PITA project 50
3.2 The rich picture used at the beginning of the workshop with policy actors in the PEG project 56
3.3 Example of a scenario map from the PEG Project: Scenario 1: Commercialisation is further postponed 58
4.1 Example cognitive map of a farmer's view 81
4.2 Example influence map constructed by one of the farmers involved in the farm scale evaluations for GM crops 83
4.3 Example of a Harman Fan compiled by the participants in the final workshop of the farmers' understandings of GM crops project 85
4.4 Example of a knowledge flow diagram drawn by participants of the conference on hedgerow futures 90
5.1 Lakeram Haynes's sketches with symbolic representations of key natural resource management areas of the North Rupununi 114
5.2 Screenshot of the Compendium-uDig integration 115
5.3 Example of an indicator spray diagram produced for Apoteri village, North Rupununi, Guyana 119
6.1 (Final) Project diagram for the organic wastes project showing the interrelationships between the different phases and elements of the investigation 134
6.2 Example issues map drawn for the organic waste project 137
6.3 Example of a force field map drawn by participants in the organic wastes project 139
6.4 Example of a complete cause and consequence scenario map 140
6.5 Participants completing a storyboard 146
6.6 A post hoc cleaned up version of a force field diagram produced in a workshop like the one shown in Figure 6.3 148

7.1a	Example conversation map	161
7.1b	Example of a re-drawn conversation map	162
7.2a	A rich picture of the current water governance situation in England drawn by one of the three small groups of workshop participants (redrawn from the version created at the workshop)	167
7.2b	A rich picture of an 'ideal' water governance situation in England drawn by one of three small groups of workshop participants (redrawn from the version created at the workshop)	168
7.3	A systems map constructed by the workshop participants (redrawn from the versions created at the workshop)	170
8.1	The five steps to producing the SSA	187
8.2	A hand-drawn amoeba diagram	188
8.3	Rich picture from CAMP Lebanon	197
8.4	Amoeba diagram from CAMP Lebanon	197
8.5	Rich picture from the Scenario planning stage of CAMP Almeria	198
9.1	Mental model or visualisation of environmental conversation showing (a) 1st order 'conversation' between practitioners and reality of environmental issues, and (b) 2nd order conversation among practitioners about the reality of environmental issues; both mediated through formalised expressions of systems, including diagramming	211
9.2	Evolutionary storyboard of an environmental responsibility heuristic	215
9.3	Evaluation-in-practice – an influence diagram illustrating six activities: (a) auditing; (b) planning; (c) evaluating (understanding); (d) evaluating (practising); (e) commissioning; and (f) learning	222
10.1	'Wordle' cloud of words appearing in definitions of sustainability	233

List of tables

7.1	Characteristics of individual and collective diagramming processes and related outcomes	176

List of boxes

2.1	Systems diagramming: mapping and modelling	28
2.2	Additional sources of information on diagramming	41
4.1	Facilitator thoughts…	86

List of acronyms

AMP6	Asset Management Programme 6
BATWOVE	Beneficiaries, Actors, Transformation, Worldview, Owners, Victims, Environmental constraints.
BoE	Band of Equilibrium
CaBA	Catchment Based Approach
CADWAGO	Climate Change Adaptation and Water Governance
CAMP	Costal Area Management Programme
CAP	Common Agricultural Policy
CoP	Community of Practice
CSH	Critical Systems Heuristics
CSO	civil society organisation
CREPE	Cooperative Research on Environmental Problems in Europe
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs (UK)
DWI	Drinking Water Inspectorate
EU	European Union
ECOSENSUS	Ecological/Electronic Collaborative Sense Making Support system
ESRC	Economic and Social Research Council (UK)
FSEs	Farm Scale Evaluations
GIS	Geographical Information System
GM	genetically modified
GST	General Systems Theory
HSE	Health and Safety Executive
ICT	information and communication technology
ICZM	Integrated Coastal Zone Management
IFSA	International Farming Systems Association
ISSS	International Systems Sciences Society
IWC	International Water Centre
LFA	Logical Framework Approach
MDGs	Millennium Development Goals
NFU	National Farmers Union (UK)
NGO	non-governmental organisation
OFWAT	Office of Water Services
OR	operational research

PAPRAC	Priority Action Programme Regional Activity Centre
PEG	Precautionary Expertise for GM Crops
PITA	Policy Influences in Technology for Agriculture
PP	participatory photography
PV	participatory video
RAC	Regional Activity Centre
RBMP	River Basin Management Plan
RDPE	Rural Development Programme for England
SCIMAC	Supply Chain Initiative on Modified Agricultural Crops
SDGs	Sustainable Development Goals
SPSA	Systemic Prospective Systemic Sustainability Analysis (an evolution of SSA)
SSA	Systemic Sustainability Analysis
SSM	Soft Systems Methodology
UDIG	User-friendly Desktop Internet GIS
WTO	World Trade Organisation

Notes on contributors

Andrea Berardi and Jay Mistry are academics working in British institutions. They have more than 22 years' experience in teaching, researching and building capacity for natural resource management with local communities. After having met while undertaking their undergraduate studies, they went on to complete a number of postgraduate degrees in environmental management and biodiversity conservation. Andrea is currently a senior lecturer at The Open University while Jay is a professor at Royal Holloway, University of London. Their particular interests include supporting local livelihoods and biodiversity conservation, local environmental governance, action research using participatory video and capacity building for natural resource management. Andrea and Jay have been involved in research in the North Rupununi since 1999 and have led all the research projects discussed in Chapter Five. The other contributors to Chapter Five are Elisa Bignante, Grace Albert, Rebecca Xavier, Ryan Benjamin, Lakeram Haynes, Deirdre Jafferally, and Géraud de Ville, whose biographies you will find below.

Grace Albert, Rebecca Xavier and Ryan Benjamin are all Indigenous community members based in the North Rupununi. Fluent in Makushi, the indigenous language of the North Rupununi, they have strong skills in community facilitation and engagement, visual methods, and their local Indigenous traditions. Grace and Rebecca have studied wildlife and natural resource management, agriculture, information technology, filming, leadership and culture, and have both worked for the North Rupununi District Development Board (NRDDB) in several roles including community radio broadcasters, community film makers and, most recently, as community researchers, including working on projects with Andrea Berardi and Jay Mistry since 2008. Ryan has experienced a number of challenges typical of a young male Indigenous community member, forced to seek employment in informal gold mines, although in the last decade he has dedicated himself to his community by, for example, being elected as one of its councillors. These experiences were invaluable in his more recent work as community researcher which began with Project Cobra in 2011.

Simon Bell is Professor of Innovation and Methodology in the Department of Engineering and Innovation at the Open University.

He has been writing on sustainability for 30 years and has written over 100 publications, including five books, with more commissioned. Simon has developed and applied a number of methodologies including: Multiview for information systems, Triple Task for group work and, most importantly, Imagine. This last approach has been applied all over the world and in all kinds of contexts from internet 2 to community conflict; from London Olympic Legacy to the future of the UK Health Service. He is currently engaged with a systemic study of climate change fear.

Elisa Bignante has more than 15 years' experience in researching and teaching in the field of development geography and in the use of participatory research methods with local communities in the global South. After achieving a BSc in Economics and PhD in Local Development and Territorial Planning, she focused on Development Geography working extensively in international aid projects in Africa and Latin America. She is currently senior lecturer at the Department of Cultures, Politics and Society, University of Torino, Italy. Elisa began her research experience in the North Rupununi in 2011 with Project Cobra after having met Andrea and Jay while undertaking a visiting lectureship at Royal Holloway in 2008.

Chris Blackmore is a senior lecturer in Environmental and Development Systems at The Open University. She has played a key role in developing Masters level programmes in Environmental Decision Making and Systems Thinking in Practice, chairing a range of modules and writing open learning materials. Her main research area is in learning systems and communities of practice for environmental decision making, including issues of social learning, systems thinking, managing systemic change, sustainability and responsibility. She has produced an extensive range of publications since joining The Open University in 1986. She developed her research initially through taking an active role in national and international multi-stakeholder processes around Agenda 21 in the 1990s, subsequently through various international research projects, including: SLIM (Social Learning for integrated management and sustainable use of water at catchment scale), LEARNing (Learning in European Agriculture and Rural Networks: institutions, networks and governance) and CADWAGO (Climate Adaptation and Water Governance).

Kevin Collins is a senior lecturer in Systems and Environment at The Open University. His interdisciplinary research and scholarship

focuses on managing socio-ecological systems using social learning and systems concepts and practices. He has produced a wide range of related publications. Since 2000, he has worked on a range of individual and collaborative research projects (SLIM; CADWAGO) centred on water resources and water policy in the UK, EU and internationally. Current projects include designing social learning systems for improving drought responses as part of the international DRIVER project. He develops, teaches and chairs undergraduate and postgraduate modules relating to systems, environmental management and research skills.

Géraud de Ville's expertise lies in the use of communication to draw bridges between research and policy, in order to facilitate cooperative and multi-disciplinary work and generate creative solutions. After achieving a number of degrees in International Development and Law, he worked for an environmental NGO in Belgium which was a partner on Project Cobra, and in 2012 enrolled at The Open University to undertake a PhD investigating how information and communication technologies affect the wellbeing of Indigenous communities in the North Rupununi, Guyana. Andrea acted as Géraud's PhD supervisor.

Natalie Foster is a research associate at The Open University. Her PhD, from Southampton University, was in environmental decision making in the context of conservation and sustainable use of intertidal mudflats and saltmarshes in the UK. She is a skilled presenter and facilitator and has considerable experience of using systems tools and techniques, including diagramming, to enable learning in a range of multi-stakeholder situations. She has worked on international and national research projects, including CADWAGO (Climate Adaptation and Water Governance) and CAPE (Community Action Platform for Energy).

Lakeram Haynes is an Indigenous researcher and community leader from the North Rupununi, with key skills in community facilitation and engagement, visual methods, environmental monitoring, and sustainable Indigenous resource management. He has had senior management and researcher roles in several projects, and first worked with Andrea Berardi and Jay Mistry in 2003. His work experience and traditional foundation provide a strong base for continued leadership and commitment in the area of community-based natural resource management in the North Rupununi. Lakeram is currently a senior

councillor for Kwatamang Village and on the management team of the NRDDB, a local Indigenous community-based organisation.

Ray Ison has been Professor of Systems at The Open University since 1994. His research and scholarship spans the biophysical and social and is primarily interdisciplinary and collaborative. He is involved in: (i) managing and presenting the postgraduate program in Systems Thinking in Practice (STiP) and undertaking associated Systems scholarship; (ii) contributing to the activities of the Applied Systems Thinking in Practice Group and (iii) undertaking international research. In 2014–15 he was President of the ISSS (International Society for the Systems Sciences); he is also a Director of the World Organisation of Systems and Cybernetics (WOSC) and Chair of Trustees of the American Society of Cybernetics. From 2008–15, having moved from a full-time to a fractional appointment at The Open University, he established and led, as Professor, Systems for Sustainability, the Systemic Governance Research Program within Monash Sustainability Institute (MSI), Monash University, Melbourne. He is the (co) author or (co) editor of five books, 35 book chapters, over 100 refereed papers, numerous other publications, five journal special editions and has delivered many invited keynotes and workshops.

Deirdre Jafferally has 17 years' experience working in community-based wildlife management and conservation. Deirdre first started working at the Iwokrama International Centre for Rainforest Conservation and Development, Guyana, in the area of environmental monitoring. This developed into a broader interest in community-based natural resource management. She was able to explore this interest during her extensive engagement with communities of the North Rupununi in managing and conserving their resources especially in the area of fisheries management. Recently, Deirdre has focused on the pursuit of a PhD exploring the implications of socio-ecological changes on Indigenous knowledge and practices, and its impact on forest conservation. Jay Mistry acted as Deirdre's PhD supervisor.

Andy Lane is Professor of Environmental Systems at The Open University. He is a Member of the Chartered Institute for Ecology and Environmental Management; a Chartered Environmentalist and a Principal Fellow of the Higher Education Academy. His research and scholarship covers (i) the management of complex environmental situations and (ii) systems of open education. He

uses systems approaches to frame the research and scholarship in both domains coupled with an action research philosophy; both use visual methods (normally diagramming) as a means to engage participants and to elicit and sometimes analyse data and evidence provided by the participants; and both use innovation and social learning as key theoretical concepts for explaining the outcomes of the research and scholarship. The work on the management of complex environmental situations looks in particular at attitudes, intentions and behaviours of the main participants in these rural or urban situations ranging from famers use of new technologies such as GM crops to organic waste recycling.

Les Levidow is a senior research fellow at The Open University, where he has been studying agri-food-environmental issues since the late 1980s. His research topics have included the following: sustainable development, agri-food-energy innovation, agricultural research priorities, governance, European integration, regulatory expertise, scientific uncertainty, and the precautionary principle. He is co-author of two books: *Governing the Transatlantic Conflict over Agricultural Biotechnology: Contending Coalitions, Trade Liberalisation and Standard Setting* (Routledge, 2006); and *GM Food on Trial: Testing European Democracy* (Routledge, 2010). He is also editor of the journal *Science as Culture*.

Sue Oreszczyn is a research fellow at The Open University. Sue runs the Open University's first year doctoral training workshops programme and is a postgraduate tutor for the School of Engineering and Innovation. She has been involved in research projects concerned with understanding the views and issues associated with agricultural environments that concern all stakeholders, from those at the policy level, such as senior policymakers, environmental NGOs and consumer groups, through to the public and the farmers working at the ground level. Sue is a Fellow of the Royal Society of Arts (RSA) and her research interests include linking policy research and practice; cooperative and participatory research; knowledge exchange; communities of practice; attitudes, values and learning concerning new technologies; systems approaches to landscape management and evaluation and agri-environmental issues; environmental perceptions and decision making. She has a particular interest in participatory methodologies and the use of visual techniques in research, such as scenario mapping, influence mapping and cognitive mapping.

Martin Reynolds is a senior lecturer in Systems Thinking at The Open University. Martin was lead editor of both *The Environmental Responsibility Reader* (2009) and *Systems Approaches to Managing Change: A Practical Guide* (2010). He has taken an active role in developing the STiP postgraduate programme at The Open University and contributes scholarship and research associated with the Applied Systems Thinking in Practice (ASTiP) Group. Martin specialises in applying critical systems thinking in practice with different areas of professional development and intervention including international development, public sector management, business development, education, health, environmental management and evaluation.

Rachel Slater is a lecturer in Sustainable Resource Management at The Open University. She has over 20 years' experience of working, researching and teaching related to sustainability. Since taking up her post at The Open University in 2002, her research has focused on social and policy aspects of waste and resource management, particularly recycling and composting. Rachel's research is collaborative and trans-disciplinary using participatory and stakeholder engagement methods; she has researched with policymakers and practitioners in the public, private and community sectors.

David Wield is Professor of Innovation and Development at the Open University and a co-director of the Innogen Institute based at The Open University and the University of Edinburgh. From 2007 to 2014 he directed the ESRC Centre for Social and Economic Research on Innovation in Genomics (Innogen), University of Edinburgh and Open University. Previously, he worked at Imperial College, University of Dar Es Salaam, Tanzania, Eduardo Mondlane University, Mozambique and Aston University. He has also been a Senior Fulbright Fellow at Stanford University/University of California, Berkeley. His research focuses on the policy and management of technology; development policy and practice with emphasis on industrialisation and technologies; innovation, knowledge and learning in organisations; and technology capabilities in East and Southern Africa. He has published ten books and over 100 journal articles.

ONE

Introduction

Sue Oreszczyn and Andy Lane

This book is based on the collective work of academics from The Open University in the United Kingdom who have been teaching about and researching complex environmental situations using systems concepts, techniques and theories for over 30 years. These techniques have particularly included the use of mapping or diagramming to visually explore, create, enquire, and communicate people's thinking and perceptions (throughout the book we use the words mapping and diagramming interchangeably to describe the visualisation practices discussed further in Chapter Two). From our experience of using mapping extensively within our research and teaching practice, and of supervising and examining many research students, we observed that there is a distinct lack of publications that provide practical examples and reflections on *actual* research projects and what happens in the practice of conducting research generally, and in particular when and how they use diagrams. Further, we found the majority of research publications, book chapters and journal articles dealing with complex environmental situations involving many stakeholders provide straightforward accounts of the methods used. They ignore the 'messiness' of the processes used, and the specific practices of the researchers are rarely analysed or explained in sufficient detail to be of more practical use to other researchers. They also do not provide an account of how such diagramming practices evolve over time, either within specific projects or within the working lives of the researcher themselves. These trajectories provide additional insights into how, as researchers, we intertwine theory and practice in understanding about, and acting in, complex environmental situations.

Diagramming in research not only represents and helps to explore the messiness, but also enables the researcher(s) to draw out and build on multiple perspectives on an issue. Involving users and non-researchers in research processes is increasingly widely accepted and is often required by research funders (see Lyall et al, 2015), particularly within the field of environmental sustainability where people need to interact to bring about desirable changes. Yet again, there is little

critique on the realities and messiness of engaging people in this type of participatory, or action-orientated, research where researchers research *with* people rather than on people. Recently environmental researchers engaged in this type of research have begun to reflect more critically on their practices. In 2014 the annual Royal Geographical Society/ IBG conference – The Geographies of co-production (London, 26–29 August 2014) – provided an opportunity for researchers from a variety of different disciplines to reflect on their particular participatory research methods. The need for development in the area of co-production of knowledge, and particularly participatory mapping techniques, and the need to describe these methodologies more precisely, has also been highlighted recently in a research call from the UK Economic and Social Research Council (ESRC, NCRM, 2015). Although visual methods in research have been developed and tested more widely, as partly evidenced by the Fourth International Visual Methods Conference held in Brighton, UK in September 2015, these methods cover a wide and diverse set of subjects and purposes that are based on an equally wide set of concepts and theories. In this book we focus on diagrams based on systems concepts in situations dealing with environmental sustainability.

Thus we have sought to produce a book that pulls together some of the lessons we have learned, individually and collectively, as researchers using mapping techniques and diagrams over the course of our research careers. Our work has been largely informed by systems thinking and practice, and includes a range of different environmental projects where participation by others was central. This is not, however, a manual on how to use a particular diagramming or mapping tool, but an account of how and why we have used such tools in our research practice. We particularly wished to reflect on our use of participatory mapping techniques for working with the many different types of stakeholders and research partners we have been involved with. We have, for example, worked with farmers, civil society organisations, government agencies, non-governmental organisations, policymakers, companies and community groups around the world on a wide range of complex and/or controversial environmental and agri-environmental issues (those involving agriculture). We wished to draw out the lessons we have collectively learned through the use of these mapping tools and techniques, first for those researching environmental sustainability, but also for practitioners involved in managing complex environmental situations (and possibly participants who are living within those environmental situations). It is our hope that other environmental researchers and

practitioners will find our experiences and uses of mapping useful for their own practices.

Our experience of research in practice is that things often do not go according to plan. So, this book provides academic and non-academic researchers, and those involved in working with stakeholders on environmental sustainability, with a very practical insight into systems-based mapping tools and techniques (tools and techniques facilitating learning by all those involved in the research, rather than simply the researchers). It also enables others to develop their own praxis based on the learning they take from our practical, often 'messy' experiences. This book therefore aims to provide more detail on research processes that involve complex environmental situations than you would normally find in publications where researchers write about their work. Moreover, we also wanted to draw on our experiences over time to provide insights into how our methodologies and methods have evolved and developed over the years.

Interweaving themes

This book has four interweaving themes. These are set out in its full title: (1) Mapping (2) environmental sustainability: (3) reflecting on systemic practices for (4) participatory research. Here we explain what we mean by each of these themes and how they fit together. In Chapter Ten, the conclusions to the book, we return to these themes.

What do we mean by mapping?

Mapping or diagramming is one form of visual method for representing the world as we see it. This is explained further in Chapter Two. Such visual methods are not restricted to research but are increasingly used in businesses and by professional practitioners in many different sectors of the economy. Some of the same methods or techniques are used in both research and business, but often with different purposes, so there is a need to be careful in employing them. However, it is also important to recognise that, for some types of research and particularly participatory research, this can mean important synergies in making the research have more impact.

Visual methods in research cover a wide spectrum of approaches as well as being used in different fields of study (Spencer, 2011; Margolis and Pauwels, 2011; Banks and Zeitlyn, 2015). These approaches include, for example, the study of 'found' iconographic, photographic and televisual images; the use of participatory or community video and

of diagrams to facilitate, explore and capture different understandings in different situations; and the use of computer based graphical packages to visualise large data sets. This by no means exhaustive list means that there is a diverse set of theoretical and methodological considerations feeding into these approaches, some common to all, some to only one or two. It is therefore important for us to be clear on where our work fits into this wide spectrum.

A distinctive aspect of this book is that it examines the specific mapping or diagramming techniques we have used within the particular systemic approaches we take. Thus the theory and practice of using mapping techniques based on systems concepts and theories as tools for researching environmental sustainability are explained, rather than mapping techniques in general. These theoretical ideas mean that we employ visual methods that facilitate, explore, and capture different people's understandings of the relationships, perspectives and boundaries within situations involving environmental sustainability. These theories help us to obtain a more complete picture of the situation and how to act within it. They emphasise the importance of taking a more holistic approach to environmental sustainability research and embrace the complexities involved, rather than attempting to reduce them. The focus is on finding ways to include different individual or group perspectives, and on relationships and boundaries, to enable action to be taken or decisions made; hence the book also focuses on participation and the roles of different practitioners within the situations being investigated.

Visual techniques, particularly when used as part of a wider research design based on a conceptual framework that places emphasis on working with people rather than doing research on them, can significantly enrich the analysis. Rather than simply considering the outcomes of what people do, these tools can be used to capture the complexity of the processes and interactions involved. They may also be used to explore strategies, different pathways for the future and solutions that people may have to current problems.

What is environmental sustainability and how can mapping techniques help?

This book is concerned with mapping techniques that have been used more specifically to consider issues relating to environmental sustainability. Like most concepts, environmental sustainability means different things to different people and also different academic disciplines. A quick online search for recent (at the time of writing)

journal articles and books that include 'environmental sustainability' in their title, came up with the following: Green logistics: Improving the environmental sustainability of logistics; Multi-objective decision support to enhance environmental sustainability in maritime shipping: a review and future directions; Planetary Praxis & Pedagogy: Transdisciplinary Approaches to Environmental Sustainability; The Power of One: How CEO Power Affects Corporate Environmental Sustainability; and Mapping future changes in livelihood security and environmental sustainability based on perceptions of small farmers in the Brazilian Amazon. This small selection indicates this diversity of possible meanings and how it probably encompasses the full range of scientific and social-scientific disciplines that touch upon environmental matters.

Yet defining environmental sustainability is not straightforward. For example, some definitions of sustainability take a more anthropocentric view, whereas others take a more holistic view. Many, however, are relational and build on the Brundtland definition of sustainable development (Brundtland, 1987), such as Morelli (2011). In his article on finding a useful definition of environmental sustainability for professionals, Morelli first notes the difficulties with finding a useful working definition of sustainability, and then suggests that the addition of environment helps it to connect more clearly to the ecological concept of interdependence. He goes on to define environmental sustainability:

> as meeting the resource and services needs of current and future generations without compromising the health of the ecosystems that provide them, and more specifically, as a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity.

Morelli then sets out 15 specific guiding principles to assist environmental professionals to operationalise the concept.

While Morelli's definition is a reasonable starting point for this book, the authors all come from different disciplinary backgrounds with different ways of viewing environmental sustainability and we could spend a lot of time teasing out and debating them as we do in the courses we teach. However, we all draw on systems thinking (as noted earlier and more fully explained below and in Chapter Two) as a theoretical and

practical framing for our work and so view environmental sustainability not as something that is a set, real and tangible goal, but rather as something that has a negotiated meaning that may change according to the context. Environmental issues can be framed in many different ways according to the different perspectives of those involved and so there can be many different answers or solutions. So each person involved in attempting to achieve environmental sustainability in a given context will have a particular view on what it is, how it affects them and others, and how it may be achieved. More than this, we recognise that it cannot be assumed that individuals or groups will necessarily be able to readily see it the way that others see it, as there are many different worldviews (that is the social, psychological and cultural 'lens' or 'window' through which we view our world).

Thus the challenges of moving towards more sustainable environmental management, in the face of both policy changes and natural environmental change, are complex, involve many actors or stakeholders, a diversity of knowledge and types of expertise and ways of seeing the world. Nearly all environmental situations or issues generally involve a number of stakeholders, whether as active or passive participants. The complexity of relationships, and the partial understanding that each stakeholder has of the whole situation, provides challenges for researching their separate views and providing ways for them to individually and collectively gain a better understanding of that situation. Such systemic understanding is required to decide upon the separate but collective actions needed to resolve the issues and/or improve innovations, practices and knowledge exchange.

What are systemic practices and why do they matter?

We have already talked about systems thinking. As explained more fully in Chapter Two, systems thinking is a different way of thinking about the world we observe and experience. Scientific thinking is based on identifying patterns and reasons for why things are as they are. It does so by breaking down the identified 'problem' into simpler parts to reduce the complexity in order to understand causes and effects or provide a 'solution' through repeatable testing. Systems thinking, on the other hand, acknowledges the complexity in many situations. It enables the researcher to identify a system of interest that contains and is contextualised by that complexity, in order to surface and explore the intended and unintended properties emerging from the system of interest. So systems thinking seeks to support people, the stakeholders, in that system of interest, explore their collective

understanding of the system, consider the power relations involved and how things might be improved. More often than not this is done through using mapping techniques that are part of the systems thinking canon. Systems thinking is not only used to investigate why things are as they are and could be, but also what should be to the satisfaction of the participants.

So it is the practices that flow from thinking systemically, in particular systems-based diagramming techniques that we find crucial to our teaching and research work. We do not see systems thinking as an alternative approach to scientific thinking and practice but as a complementary approach, given that systems thinking is all about recognising and valuing different perspectives and methods. Indeed systems thinking itself can be used in scientific studies, for example, in operational research and mathematical modelling. However, this book focuses on our work on complex environmental situations involving stakeholders or others who are both part of that situation and very often being affected by it now and in the future. Thus it involves investigating human activity systems more than natural or physical systems, although as we are looking at environmental sustainability, an understanding of the natural and physical processes and patterns is not ignored.

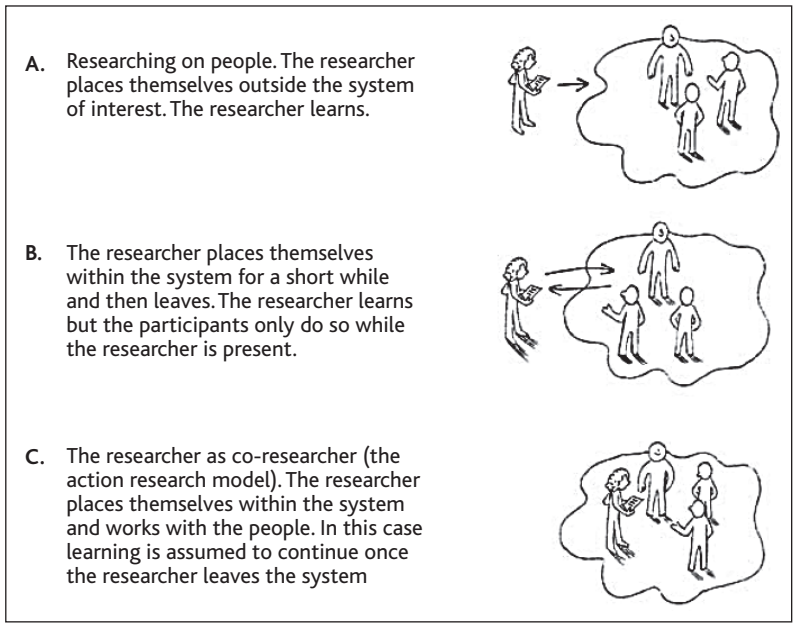
Participatory research: why engage users?

There are different ways of doing research – see Figure 1.1. While some researchers act more as critical observers – analysing and passing commentary on what they see happening before them – others are concerned more directly with influencing the situations they see before them.

The latter is where participatory and more action-orientated research sits. This type of research seeks to address the way that most forms of research tend to be 'expert' led and give more weight to expert opinion than that of the stakeholders, actors or participants in the system of interest. Non-researchers tend to be involved in the research as subjects rather than as equal participants (Phillipson et al, 2016). Such research further seeks to address the way that research dissemination tends to pay little attention to how much is actually assimilated by the users of the research, and to what extent the users consider it to be relevant. Introducing stakeholder and user engagement within the research process itself in a participatory way offers a means of ensuring that research is both relevant and useful to those who may make use of it.

Participatory research involves working in a more equal way, often with different academic disciplines, practitioners and users of

Figure 1.1: The relationship between the researcher and the system of interest



Note: Although three discrete models are depicted here, in practice it is more a continuum.
Source: Oreszczyn, 1999

the research (or those affected by it) working together. It recognises the value of the many different types of knowledge or expertise involved. Emphasis is placed on the inclusion of a range of different stakeholders to ensure research is relevant, useful and also grounded in the 'real' world. Not only are attempts made to draw in those who may previously have been excluded from research processes, but also for researchers to work *with* people, so placing emphasis on the importance of learning by both the researcher and those involved in the research.

The development of these more participatory models has often drawn on systems theories (see, for example, Leeuwis and Pyburn, 2002; Cerf et al 2000; Roling and Wagemakers, 2000). Such models place an emphasis on how environmental knowledge may be co-constructed or co-created. Social learning has also developed as a significant theme in the literature on environmental management. Social learning refers to the process of iterative reflection that occurs when we share our experiences, ideas and environments with others (Keen et al, 2005). These theories share many ideas with the field of Action Research and Participatory Action Research. As Bradbury

(2010) notes, 'action researchers seek to take knowledge production beyond the gate-keeping of professional knowledge makers' (Bradbury, 2010: 93). People working together in partnership helps to address the complexity of economic, environmental, social and technological problems the world faces. Through such partnerships, research institutions and organisations go beyond simply working with one another and expand their networks, and ways of doing things, to include and involve others, such as public, private and civil society organisations (CSOs) or non-governmental organisations (NGOs), policymakers and members of the public.

So today, transdisciplinary research (see for example, Lang et al, 2012; Lawrence, 2015; Bracken et al, 2015; Bernstein, 2015; Lyall et al, 2015), participatory research and action research (see Bradbury, 2015; Allen, 2016) are all significant themes in the academic literature and are evolving research practices. All recognise the way that not all knowledge comes from formal or conventional research processes. They seek to formalise the informal knowledge through greater engagement with, and interactions between, formal researchers and those who may have in the past been viewed simply as those to be researched on. As you will see in this book, in this type of research, co-building knowledge and mutual learning between researchers and non-researchers becomes important and processes such as self-reflection and joint reflection form necessary elements of these kinds of research projects. However, while reflection on the outcomes or impacts of research are becoming increasingly important in the current research environment (see Lyall et al, 2015), reflections on the processes involved are equally important. Indeed, it is the processes themselves that may end up having the most important impacts. This is something we will return to in the final chapters of this book.

Putting it all together

A key feature of this book is the way we reflect on not just one particular research project, but on our collective research on many different projects over a lengthy period of time. This has enabled us to draw out the way that, as a necessary aspect of our research, our research projects, in their individual ways, have become increasingly more participatory over time. This mirrors the academic move towards finding ways to better engage with research participants as noted earlier. Our personal reflections on our work and the transitions in methodology and method that we have made offer an insight into why this change has transpired and how the challenges it creates may be addressed.

The mapping techniques and diagrams that the authors in this book use are not used in either a simple way or a single way. While for some authors diagramming was used as only a small part of the research project, for others it formed part of the overall framing and was central to all stages of the research. As noted earlier, the authors are all committed to researching sustainable environments *with* people. These visual techniques help us to foster conversations between people, to express our research processes and aid our methods. There are many different ways to involve stakeholders (that is, people with a stake or interest) in your research (see Bracken et al, 2015) and the authors in this book have engaged with people in a variety of different ways, and at different levels; that is, from those working in the policy environment to those working in practice on the ground. However, a key aspect is that they have sought ways that enable relevant participants in their research studies to research and, crucially, to learn together and so better connect on the ground practice with environmental management and policy. Another feature of the authors' research as it has developed is that, where possible, it has been concerned with going beyond participatory research that simply engages with people to that which involves them more fully, for example, from the initial conception of the project. Greater ownership of the project, or outcomes, offers greater opportunity for any benefits to last beyond the life of the initial research project funding. However, as earlier noted, researching with people is not straightforward. The multifaceted nature of environmental projects and the complex sets of practices and ways of seeing environmental issues combine with a variety of roles and identities, relationships and social interactions, benefits and issues that the researcher has to contend with.

The case studies in this book explain how mapping techniques have helped us deal with these issues (or not) in real research projects around different aspects of environmental sustainability. Chapter authors critically reflect on their experiences and examine the ways in which systems-based mapping techniques may or may not contribute to improving understandings and actions for environmental sustainability. Where possible, perspectives from those we have worked with are also included.

Structure of the book

In **Chapter Two** you will find an overview of systems thinking and practice – notably diagramming – including descriptions of the most common types of systems diagrams used by the various authors in this

book and how these diagrams may be used for working with others. The authors of this chapter – Andy Lane and Martin Reynolds – first introduce the particular systems approach to research and mapping taken by the authors in the book. As noted earlier, systems thinking in practice is a particular way of approaching the understanding of messy situations such as those associated with environmental sustainability. The authors explain the core concepts of systems theories and how they may be used for sharing multiple perspectives on complex situations. They comment on the importance of systems-based mapping techniques and demonstrate how these systems ideas and techniques may be used in practice. The chapter gives a flavour of a range of different types of mapping you could use in your research and practice. Where necessary the authors point you in the direction of further sources of information on how to use them.

Chapters Three to Nine then provide examples of how mapping has been used in our research from different case studies.

In **Chapter Three** Sue Oreszczyn, Les Levidow and Dave Wield draw on 13 years of research involving three large and increasingly more participatory European Commission funded projects. In their first project they describe how participants were necessarily treated more as informants than project partners. Cognitive maps were used to focus on technology strategies and trajectories of 14 major agro-chemicals and seeds companies. The maps highlighted the thinking of key actors in decision making about new technologies and were used as an essential form of analysis in the project. Their techniques evolved with the use of a more participatory approach in a second project in an attempt to better link policy, research and practice. In this case a scenario mapping technique was used with senior policy actors, to explore potential futures for genetically modified (GM) crops in the UK. A third and final project they describe, while not an exemplar of mapping techniques, is included as it is a unique example of participatory or partnership research. The unusual funding arrangement, whereby all project partners (academics and CSOs) received equal funding, meant that rather than the academic partners taking the lead on the research, researchers and non-researchers worked together in a more equal way and had more equal stakes in the research. CSO researchers and academic researchers all devised the project at the outset and developed the processes within it as it progressed.

In **Chapter Four** Sue Oreszczyn and Andy Lane also consider the increasingly more participatory approach to their research over time, through one big project and two follow-on opportunities.

Three mapping techniques – cognitive mapping, influence mapping and scenario mapping – were used at different points within a single three year project as it became increasingly more participatory. The project considered farmers' understandings of GM crops and new innovations more generally and, like Chapter Three, highlights the advantages of using mapping techniques when exploring different perspectives on controversial environmental issues. The authors also reflect on the subsequent work this project led to regarding knowledge flows. They provide insights from their work with various stakeholders to consider complex interactions among knowledge brokers in a number of different contexts – agriculture, health, food, international development and hedgerow management systems. This chapter also provides examples whereby diagrams, and processes for their use, were necessarily specifically devised for the circumstances of the research project – rather than the researchers using something 'off-the-peg'.

Chapter Five portrays the development of a research programme involving a number of phases and funded projects over the longer term. Andrea Berardi, Jay Mistry, Lakeram Haynes, Deirdre Jafferally, Elisa Bignante, Grace Albert, Rebecca Xavier, Ryan Benjamin and Géraud de Ville depict a lay expertise model of development where local people promote their own solutions to environmental problems. The authors comment on the way their methodological approach changed over the 15 years of researching with indigenous forest communities in Guyana to find solutions to their complex environmental issues. Their initial expert led approach, using quantitative methods, became increasingly participatory as more appropriate qualitative and visual methods were employed. The chapter provides an example of how such techniques can be used to overcome communication barriers, such as different languages or cultures and how they can aid the interactions between academic researchers and non-academic researchers and between local people and policymakers. Importantly, this chapter also provides an example of how research and visual techniques may be used not simply to empower local communities to take action themselves but also to take ownership, offering the potential for longer term outcomes.

In contrast **Chapter Six** portrays two research projects that were more constrained as a result of the nature of their funding. Andy Lane, Rachel Slater and Sue Oreszczyn draw on their experiences of two UK government department funded environmental projects of contrasting scale concerned with issues around managing organic waste within a much bigger government research programme on waste in general. The broad scope and purpose of both projects were specified

by the funder, which placed constraints on the approaches to be used, as did the need to report regularly to the funder. In both projects the use of visual mapping techniques was central to the research process and the research outcomes. In the first project, a study of attitudes and perceptions towards the spreading of organic waste-derived resources on land, they brought together for the first time attitudes of stakeholders from all parts of the organic resources use cycle in an interactive and iterative research process. The second project explored the potential of community composting in contributing to government waste targets and wider social objectives. The authors of this chapter comment on the way that stakeholder perspectives were drawn in at each stage of the projects as the project evolved. The projects worked closely with the funders and were intended to directly inform further research and/or current policy decisions and so the authors specifically reflect on the impacts on both policymakers and practitioners.

In **Chapter Seven** Chris Blackmore, Natalie Foster, Kevin Collins, and Ray Ison draw on their experiences over many years of research into social learning systems. The authors particularly focus on their work on communities of practice as social learning systems and reflect on their experiences of using diagramming to map and share understandings and develop knowledge, in the context of water governance and climate change. As with the other authors in this book, they build on a range of systemic and participatory traditions to design their research processes. Some of the authors have also taught these techniques and have developed an understanding of how skills in diagramming can be developed both for exploration and for communication. The authors therefore reflect on the effectiveness of diagramming processes for different purposes, reviewing a range of the techniques' strengths and limitations from their use in different contexts.

In **Chapter Eight** we turn to the development of a research method – Imagine – to address a particular issue influenced by systems thinking and diagramming over a number of years. In this case Simon Bell tells the story of the development of sustainability indicators that aimed to include the needs of the variety of different stakeholders, rather than just policymakers and scientists. Such indicators tell us how much oil we have left, how our GDP is growing or shrinking, how our planet is warming, how much pesticide our crops are using, how much our health is costing, for example. The chapter describes the way he and colleagues got people in communities to think about sustainability by using indicators and metrics. The evolving project that he describes provided a generic means to allow communities to engage in the

discussion with these metrics that can be used by non-specialists. Two particular types of participatory mapping techniques were involved in the projects development – rich pictures and an Amoeba diagram. Both techniques were used to assess which aspects of sustainability the various stakeholders thought was most important at a particular time, but also historically and in the future. This chapter also describes and reflects on how the approach described has been taken up and applied in a range of different European countries in the context of managing coastal environments, with the process evolving as the projects moved from location to location.

Martin Reynolds in **Chapter Nine** takes a rather different approach. In this chapter he addresses failures with interventions addressing complex issues of sustainability and the need, at all levels, for evaluation of interventions. He notes the lack of adoption of new ideas in this area and the way that stakeholders are often talking past each other. He considers how diagramming can address this by making space for conversations (between thinking and practice) in disciplinary, interdisciplinary and transdisciplinary research practice. Drawing on the ideas introduced in Chapter Two this chapter explains the use of a particular systems-based influence diagram Martin has developed and adapted over the past 15 years and discusses diagramming as both a means of praxis (the braiding of thinking and practice) generally, and more specifically, as a means for evaluating environmental sustainability as praxis.

Finally, **Chapter Ten** draws the themes of the book together once again and in particular reflects on the use of the mapping techniques used by the various authors in the book in helping the research process. It highlights key aspects and outcomes from the case studies and considers the lessons that may be learned for researching environmental sustainability.

References

Allen, W. (2016) 'Learning for sustainability' website, http://learningforsustainability.net/action-research

Banks, M. and Zeitlyn, D. (2015) *Visual Methods in Social Research*, London: Sage.

Bernstein, J.H. (2015) 'Transdisciplinarity: A Review of Its Origins, Development, and Current Issues', *Journal of Research Practice*, 11(1), Article R1, http://jrp.icaap.org/index.php/jrp/article/view/510/412

Bracken, L.J., Bulkeley, H.A. and Whitman, G. (2015) 'Transdisciplinary research: understanding the stakeholder perspective', *Journal of Environmental Planning and Management*, 58(7): 1291–308.

Bradbury, H. (2015) *The SAGE Handbook of Action Research*, 3rd edition, London: Sage.

Bradbury, H. (2010) 'What is good action research? Why the resurgent interest?', *Action Research* 8(1): 93–109.

Brundtland, G.H. (1987) *Report of the World commission on environment and Development: Our Common Future*, www.cfr.org/economic-development/report-world-commission-environment-development-our-common-future-brundtland-report/p26349

Cerf, M., Gibbon, D., Hubert, B., Ison, R., Jiggins, J., Paine, M., Proost, J. and Roling, N. (eds) (2000) *Cow up a Tree: Knowing and Learning for Change in Agriculture*, Paris: INRA.

ESRC, NRCM (2015) *National Centre for Research Methods call for Methodological Research Projects*, call specification, www.esrc.ac.uk/files/funding/funding-opportunities/ncrm/ncrm-methodological-research-projects-call-specification-pdf

Keen, M., Brown, V.A. and Dyball, R. (2005) 'Social Learning: A new approach to environmental management', in M. Keen, V.A. Brown, and R. Dyall (eds), *Social Learning in Environmental Management: Towards a sustainable future*, London: Earthscan, pp 3–21.

Lang, D., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Mool, P., Swilling, M. and Thomas C.J. (2012) 'Transdisciplinary research in sustainability science: practice, principles, and challenges', *Sustainability Science,* 7 (Supplement 1): 25–43

Lawrence, R.J. (ed) (2015) 'Advances in transdisciplinarity 2004–2014', *Futures*, 65: 1–216.

Leeuwis, C. and Pyburn, R. (eds) (2002). *Wheelbarrow full of frogs: social learning in rural resource management*, The Netherlands: Koninklijke Van Gorcum BV.

Lyall, C., Meagher, L. and Bruce, A. (2015) 'A rose by any other name? Transdisciplinarity in the context of UK research policy', *Futures* 65: 150–62.

Margolis, E. and Pauwels, L. (eds) (2011) *The SAGE Handbook of Visual Research Methods*, London: Sage.

Morelli, J. (2011) 'Environmental Sustainability: A Definition for Environmental Professionals,' *Journal of Environmental Sustainability*, 1(1), Article 2, http://scholarworks.rit.edu/jes/vol1/iss1/

Oreszczyn, Sue (1999) 'Participative approaches to hedgerow conservations', PhD thesis, The Open University, http://oro.open.ac.uk/30150/

Phillipson, J., Proctor, A., Emery S.B. and Lowe, P. (2016) 'Performing inter-professional expertise in rural advisory networks', *Land Use Policy*, 54: 321–30.

Roling, N. and Wagemakers, M.A.E. (eds) (2000) *Facilitating sustainable agriculture: Participatory learning and adaptive management in times of environmental uncertainty*, Cambridge: Cambridge University Press.

Spencer, S. (2011) *Visual Research Methods in the Social Sciences*: *Awakening Visions*, Oxford: Routledge.