Using an Ecological Metaphor to Build Adaptive and Resilient Research Practices[1]

Maureen G. Reed

Department of Geography, University of Saskatchewan, 9 Campus Drive, Saskatoon, Saskatchewan, Canada S7N 5A5 E-mail: m.reed@usask.ca

Evelyn J. Peters

Department of Geography, University of Saskatchewan, 9 Campus Drive, Saskatoon, Saskatchewan, Canada S7N 5A5 E-mail: evp818@duke.usask.ca

Abstract In this paper, we reflect on our efforts to undertake qualitative research in our investigations of the geographies of Aboriginal people and of rural communities across Canada. In particular, we consider the ecological metaphor to describe the nature of power relations between researched and researcher in the production of situated knowledges. Gillian Rose, in her influential 1997 article, 'Situating knowledges: Positionality, reflexivities and other tactics', suggested that these relations might be conceptualised as ecological, characterised by fluid connections among researcher, researched and text, marked by fragmented understandings and uncertainty throughout research and distribution practices. Although not fully developed as a metaphor in her work, Rose sees the relationship as potentially risky for the researcher and for the research subjects and thereby draws a fairly pessimistic conclusion about the outcomes of the research relationship. We have been inspired by this notion and seek to develop the ecological metaphor in this article by drawing on contemporary systems ecology that emphasises the uncertainty and

---

surprise inherent in ecological-social systems. In contrast to Rose's pessimism, we suggest that research practices can be designed to embrace the uncertainty and partiality of knowledge creation as well as the dynamism of the research process by methods that are adaptive and resilient. We suggest that such a position has implications for four elements of our research: preparing for surprise, how we involve research participants, how we consider our roles as researchers, and how we define research success. We interrogate our own research experiences to develop this framework and to identify challenges of putting it into practice.

Introduction: The powers of research

Feminist geographers, among other critical scholars, have long documented dilemmas of primary research. The dilemmas relate to irreconcilable, contradictory, and partially-understood issues of power and their implications for establishing research questions, engaging in field work, writing up results, and for the nature of the relationship between research subjects and researchers (Moss *et al*. 1993; McDowell 1992; 1993a; 1993b; Katz 1994; Staeheli and Lawson 1995; Pratt 2000). Some researchers have suggested that participatory and collaborative research practices may begin to address unequal power relations among academic and community-based researchers (e.g. Howitt 2001; Kindon 2003; Monk, Manning and Denman 2003; Pain and Francis 2003).[2] To contextualise understanding, researchers have been encouraged to make the research process more visible, to make explicit the implications of the researcher's (or researchers') position, to destabilise the universality of research findings, and ultimately to "recognise and take account of our own position, as well as that of our research participants, and *write this into our research practice*" (McDowell 1992, 409, quoted by Rose 1997, emphasis in Rose).

Gillian Rose's (1997) provocative article, 'Situating knowledges: Positionality, reflexivities and other tactics', considered the implications of this call to better practice. Her impetus was the impossibility of providing a transparent, reflexive, and situated account of her own role in the creation of knowledge. Despite the insistence by feminists to be reflexive in their research practices (an argument to which she is favourable), Rose effectively and poignantly illustrated that there are limits to achieving reflexivity, particularly in a transparent form. To paraphrase her, sometimes we simply do not know every aspect of our own position in relation to our subjects.

While Rose's paper is frequently cited, some researchers have been critical of parts of her analysis. Lise Nelson (1999) noted that, because Rose relies on Judith Butler's conceptualisation of performativity, she cannot allow for the possibility of theorising conscious reflexivity or agency. As a result, Nelson argued that Rose misreads feminist arguments that it is possible for researchers and research subjects to negotiate new understanding from the "unstable space of betweenness" (Katz 1994) that results from their inability to fully understand each others' subjectivities (Staeheli and Lawson 1995). Sara Kindon and Alan Latham (2002, 20) suggested that Rose's reaction to the ethical issues and practical difficulties involved in interviewing is a "relatively rare and strong reaction to the challenges presented" while Karen Falconer Al-Hindi and Hope Kawabata

---

[2] We note that the notions of power discussed in this paper and in the cited works are based on westernised concepts and illustrations.

(2002) were concerned that Rose's sense of failure and withdrawal from interview-based research marked a missed opportunity to truly share power with and validate the knowledges of research participants. They implied that a more direct effort by Rose to broaden the base of reflexivity and to let go of the structure of the research process, regardless of her personal discomfort, might have been more effective in pursuing feminist research agendas and approaches.

The purpose of our own paper is somewhat different from these engagements with Rose's arguments. Rose proposes, but does not develop, an ecological metaphor to trace the relations of power that circulate within and throughout a research process. Drawing on contemporary systems ecology, we consider how an ecological metaphor can shed understanding on our roles and relationships as academics in the research process. Therefore, we do not critique Rose's position with respect to her use of the ecological metaphor to elucidate positionality or self-reflexivity of the researcher. Rather, we use her metaphor to spark new ways of thinking about the dynamics of research practices and the location of the researchers within them.

We begin by documenting Rose's metaphor in relation to other metaphors of power described in research. Next, we examine metaphors of nature used by ecologists to help them conceptualise the effects of human intervention in natural-social systems. Our intention is *not* to suggest that research subjects act like accounts of nature in ecological systems. Rather, our purpose is to enrich the metaphor identified by Rose and expand its usefulness to social scientists by drawing on the ecological science that gave rise to it.[3] From this discussion, we suggest that research practices can and should be designed to deal with the inevitable uncertainties and surprises that accompany our research. We identify and discuss a framework consisting of four elements that might help build adaptive and resilient research practices and place our own research experiences into this framework by providing vignettes that raise pertinent issues. In doing this, we seek to offer opportunities for reflection and debate, rather than to close discussion by suggesting we have found 'the' answers.

Metaphors of power and reflexivity

Geographers have used landscape, spatial, and ecological metaphors to describe power relations embedded in research relationships.[4]   These metaphors have assumed that power flows primarily from researcher to research subject. As Rose (1997) pointed out, flows of power are rarely one way and hardly predictable; instead power relations are so

---

[3] We use science in the broadest sense. We argue that ecological theory, particularly applied ecological theory, is social theory because it considers humans as part of 'nature' and develops theory from interdisciplinary approaches used in both the social and natural sciences.

[4] Perhaps ironically, this trajectory of metaphors follows the trajectory of the discipline itself. Landscape metaphors have some parallels with geography's accounts of regionalism; spatial metaphors, to some degree, reflect understandings gained by spatial modeling of the 50s and 60s (see Rees 1990), and the use of an ecological metaphor reflects the rise of interest in human-environment interactions through the 1970s to the present. We also acknowledge that there are many other metaphors for research practices. For example, Geraldine Pratt's (2000; Pratt and Kirby 2003) use of research as performance is an attempt to disrupt such a clear delineation of power relations and to expose practices that are much livelier and more varied than those conventionally described.

complex that we are simply unable to reflect in a transparent way about the possible permutations and diffusion of power. Consequently, we cannot know all of the ways our position affects how people respond to us, or how our histories and experiences affect what we notice and how we interpret our results**.** Like Geraldine Pratt, she suggested that transparent reflexivity may merely be another means of attempting a distanced appraisal of one's situation. Hence, the act of locating oneself in the research process "serves the purpose of stabilising the process and removing bias in order to uncover the truth" (Pratt 2000, 641).

This web of interpretations and power relations is at the heart of the ecological metaphor. Rose (1997, 317) suggested that:

> the landscape of power produced by transparent reflexivity is not the only space through which the power of the academic to produce knowledge can be situated. There is also a much more fragmented space, webbed across gaps in understandings, saturated with power, but also, paradoxically, with uncertainty: a fragile and fluid net of connections and gulfs.

Furthermore, Rose used the ecological metaphor to illustrate the powers of research subjects. In her words, "webbed connections are not made by the researcher alone" (Rose 1997, 317). Thus,

> what audiences may do with a piece of research is unknowable…. the effects of an interview, a publication, a presentation, are impossible to predict. This impossibility does not absolve researchers from the obligation to work in an ethical manner (Haraway, 1991; Keith, 1992). It does suggest, however, that the researcher is not the only authority on academic knowledge and its effects (Rose 1997, 317).

She concluded that "we cannot know everything, nor can we survey power as if we can fully understand, control or redistribute it. What we may be able to do is something rather more modest but, perhaps, more radical, to inscribe into our research practices some absences and fallibilities while recognising that the significance of this does not rest entirely in our own hands" (Rose 1997, 319). Ultimately, Rose sided with Donna Haraway (1991); feminists instead should seek to produce and reinforce nongeneralising knowledges and advance strategies that acknowledge the gaps of meaning and interpretation in our research efforts.

We are sympathetic to her basic argument. Yet, the final conclusion she draws from this metaphor is curious. "Seen from this perspective, the research process is *dangerous* (our emphasis). It demands vigilance, a careful consideration of the research process: another kind of reflexivity, in fact, but one which can acknowledge that it may not be adequate since the risks of research are impossible to know." (Rose 1997, 317). It is not clear to whom the process is dangerous. Does Rose speak of the researcher(s)? The research subject(s)? The project itself? All of the above? It appears to us that by "danger" she refers to the possibility of unacknowledged and unanticipated responses from research subjects, and to the possibility that results will be different from what the researcher(s) expected. This is only "dangerous" when we, as academic researchers, expect our research to do certain things, e.g. fit within our conceptual framework(s), meet narrow definitions of academic validity and reliability, produce anticipated results, and/or create a controlled and predictable relationship between academic researchers and other participants. Danger, for

Rose, seems to lie in the potential for making grave mistakes and ultimately failing to understand the nature of our research participants and challenging theoretical premises.

The conclusion drawn from the ecological metaphor, that our knowledge is fragile and the researcher is in danger of making mistakes, appears to draw on a very particular idea of ecology. A more detailed examination of applied systems ecology[5] reveals the potential for quite a different conclusion. We argue here that if we design our research differently, then the concern of making mistakes and admitting failure need not paralyse our efforts. Indeed, applied systems ecology suggests quite a different outcome, suggesting the possibility of creating adaptive and resilient practices to address our uncertainty and our partial and situated knowledges.

We recognise that other researchers have come to similar conclusions about aspects of research practice that we associate with an ecological model. For example, feminist and other critical geographers have long been aware of how the politics of their multiple positions affect field work and research processes more broadly (McDowell 1992; Miles and Crush 1993; Momsen 1993; Rose 1993; England 1994; Katz 1994; Kobayashi 1994; Nast 1994; Staeheli and Lawson 1995). Indeed, Audrey Kobayashi (1994) stressed how field work, especially ethnographic field work, performs functions outside of those ascribed by the researcher. Qualitative methodologies such as ethnography or participatory action research emphasise emergent properties of research practice, involvement of research subjects, and demonstrate the need to embrace flexibility, adaptation, resilience, and reflection in research (Jackson 1985; Cook and Crang 1995; Flowerdew and Martin 1997; Herbert 2000; Limb and Dwyer 2001; Kindon 2003). We do not claim that using an ecological metaphor provides original insights in all of these areas. Instead, we have found that it usefully organises and illustrates the intersection of a variety of research practices from different fields, as well as provides some new perspectives on research practice, regardless of which methodologies are used.

The Natures of Ecology

One of the leaders of applied systems ecology in the late 20th Century is Professor Emeritus C.S. (Charles Stanley) (Buzz) Holling who broke new ground in 1978 with his book entitled *Adaptive Environmental Assessment and Management* (Holling 1978). Since then, he and a number of colleagues developed a paradigm of applied systems ecology that has been enormously influential in environmental management and policy making in Canada, the United States, Europe, and India. In creating this body of work, Holling documented ideas of nature that have dominated environmental science and management strategies in the 20th Century (e.g. Holling 1973; 1978; 1986; 1995; Gunderson, Holling and Light 1995; Gunderson and Holling 2002). We draw on several ideas here that are relevant to research practices.

---

[5] We note here that we draw only from one branch of ecological theory. When we refer to 'ecology', we specifically mean applied systems ecology as developed by the cohort of researchers described here.

The first idea about nature is that *nature is benign* (Holling 1978; 1995; Gunderson and Holling 2002).[6] Ecosystems are stable; they resist disturbances, and quickly return to equilibrium after disturbance. In environmental science, this view leads to the assumption that environmental resources are manageable and yields predictable. Managers believed that nature could absorb system changes, and/or that nature would revert back to a normal operating condition once the intervention was removed. As outsiders of natural processes, humans could manipulate and observe system responses in a straightforward way. These understandings sanctioned large-scale water diversion projects, clear-cut logging practices, maximum sustained yield fisheries management prescriptions, and mid-Century fire prevention strategies.

The parallel for research is that we can gain understanding through conventional, equilibrium-centred, linear, cause-and-effect predictive approaches. Furthermore, this perspective suggests that researchers are outside the research project and that although their interventions can have temporary effects on their research subjects, these effects do not necessarily destabilise the processes or systems that are being investigated or, in this way, produce misleading results. Instead, the challenge is to execute a research design to reduce or even eliminate its associated disturbance(s), thereby generating accurate knowledge about the subject of research. This kind of social research design is consistent with a landscape or distance metaphor of research where the researcher is in control of, and separate from, those under investigation. It implies that researchers can and indeed must take care not to influence the subject by the actions associated with research investigations.

A second view suggests that *nature is ephemeral* or *anarchic* (Holling 1986; 1995). Ecological systems have a high degree of instability; ecosystems are considered fragile, with a natural rhythm of small-scale extinctions. In this viewpoint, ecosystems persist only because of the diversity of their structure and spatial distribution. Persistence is only possible in a decentralised system in which there are minimal demands on nature. This viewpoint emphasises the importance of spatial variety, diversity of opportunity, and especially local autonomy. Its social corollary was epitomised by Ernst Schumacher's (1973) treatise on economics, "small is beautiful". He argued that any human intervention using large-scale technology would inevitably be destructive to environment and society. With ephemeral nature, the management prescription was based on minimal intervention, with concern for the nature of the technology employed, and the scale of its application. In some cases, such as in wildlife management, managers advocated a "do nothing" approach, believing that humans only interfere with and destroy an otherwise natural balance or ecological climax (for examples, see Botkin 1990).

The corollary for research is the belief that research practices are almost always disruptive to "normal" social or ecological behaviours. Research is best tackled at more limited scales, both spatially and temporally. Research should not be focused on establishing generalisable, yet simplistic, cause-effect relationships, but rather on the complex interaction of processes that make up reality. The object of research becomes to gain a greater understanding of context in the hopes of improving predictive capabilities.

Despite offering almost opposite conclusions about the fragility or robustness of natural systems, and the appropriate scale of human interventions, both these perspectives

---

[6] We acknowledge that over time Holling used slightly different terminology as he navigated through his ecological theory.

lend credibility to the notion that changes in nature are predictable. In short, there is a singular, definable "balance of nature". Nature follows fairly regular and predictable patterns that, once ascertained, can be used to 'manage' natural systems (Botkin 1990). If these ideas are considered in terms of research practices, the researcher is located at some distance from those researched. It follows that a transparent reflexivity in research practices can and should be achieved. In the one case, the effects of research are justified by its utility and ability of nature to absorb change, while in the other, the smaller scale of one's interventions helps to reduce the negative effects.

The impossibility of establishing this trajectory of distance and of reflecting in a transparent way is a key insight by Rose and led to her anxiety over the impossibility of 'managing' all facets of the research process. This scepticism is shared by systems ecologists who now suggest that attempts to manage human-environmental interactions through systems of control and understanding are doomed to failure.

Contemporary systems approaches to applied ecology and environmental management argue that humans and nature are intricately connected (Ludwig, Hilborn and Walters 1993; Berkes and Folke 1998; Berkes, Colding and Folke 2003) and the activities of nature are seldom linear and predictable (Lee 1993; Gunderson, Holling and Light 1995; Walters 1997; Gunderson and Holling 2002; Berkes, Colding and Folke 2003). This perspective is consistent with Holling's (1978; 1995; Gunderson and Holling 2002) suggestion of *nature as a practical joker* or *nature resilient*. In one sense, this perspective began as a combination of the two extremes. Holling, among others, argued that many natural systems can and do have more than one stable mode of behaviour. For example, as long as variables, such as population density, or amount of nutrients, stay within a certain range, small disturbances can be absorbed or accommodated. This means that while quantities of these variables may change, qualitative behaviour does not. Therefore, small disturbances can be introduced gradually without threatening the integrity of the system. However, eventually one extra increment of change or disturbance can "flip" or push the system across a boundary into some totally different type of behaviour. In this view, managers must take more caution than in previous approaches in order to avoid situations in which system gets too close to a *dangerous* boundary or threshold. This admission of danger runs parallel to Rose's conclusion.

But, this is not the end of the ecological story. Holling (1995; Gunderson and Holling 2002) has since offered a new metaphor suggesting that nature is a resilient entity that is constantly evolving. *Nature evolving* is one of a nested system of cycles organised by fundamentally discontinuous events and processes. This nature goes through periods of exponential change, growing stasis and brittleness, followed by readjustment or collapse, and reorganisation for renewal. Resilience refers to the ability of individuals, institutions, and natural systems to absorb perturbations (i.e. retain key controls on functions and structure even though composition may change) and adapt to change (i.e. self-organise, build and increase capacity for learning and adaptation). In the case of humans, this includes the capacity to anticipate and plan for change (see Resilience Alliance 2002). Furthermore, Holling (2000) states that the fundamental paradox of ecosystems is that "change is essential, and yet stability is necessary….novelty and change coexist in a context of persistence and stability" (Holling 2000, 5). Resilience is achieved through the interplay between stability and change. Furthermore, by considering the interlinked and never-ending adaptive cycles of growth, accumulation, restructuring (including destruction), and renewal of ecological and social systems, it is possible to identify how

systems can accept positive change and to foster resilience and sustainability (adapted from Holling 2000). In Holling's words, "it is as far a cry from public perceptions of fragile, stable, and equilibrium nature as could be imagined" (Holling 1995, 18).

These metaphorical refinements of ecological systems tempers the conclusion that any management approach can control for unexpected results or that any research practice (in the social or in the natural sciences, or in the spaces in-between) can predict the nature of research relationships for at least two reasons. First, if more than one stable mode of behaviour is normal, then it follows that uncovering what is "normal" is particularly perplexing and complex. After years of experimentation and observation across several studies, Holling concluded that frequently the scale of study is too truncated both temporally and spatially for scientists to completely understand what is being observed (Holling 1995). Consequently, scientists may not be able to clearly identify when and under what conditions a system is exhibiting one of its normal modes of behaviour or a flip to a new operating point that compromises a system's integrity. Second, the push to narrow uncertainty of knowledge so that argument among scientific peers (and research subjects) is essentially unambiguous, is achieved primarily by acquiring agreement that is at best incomplete and fragmentary (Holling 1995). Researchers are only "in control" of the results when they pertain to a small proportion or trivial elements of the system under study.

Nature evolving recognises that nature is always changing; before, during, and after we study it. The result is recognition that our knowledge of the system under study is *always* incomplete, the science is incomplete, and the system itself is a moving target, evolving because of general human impacts and because of our own studies (adapted after Holling 1995, 13). Fikret Berkes and Carl Folke followed up (1998, 12) arguing that it implies "a fundamentally different view of science, in which determining causal effects and making predictions are not simple matters at all. Rather, systems are seen to be complex, non-linear, multi-equilibrium and self-organising; they are permeated by uncertainty and discontinuities." What constitutes "normal" behaviour of ecological systems is complex and *fundamentally* unknowable, in its entirety. Rather, researchers must "move away from the emphasis on objectivity and toward a recognition that fundamental uncertainty is large, yields are unpredictable, certain processes are irreversible, and qualitative judgements do matter" (Berkes and Folke 1998, 12).

Holling (among others) concludes that because of the nature of ecological systems, environmental policies or management practices that try to reduce variability by delimiting the boundaries of the unknown (either as an objective in itself or to meet certain safety or other standards), can interfere with the production of useful knowledge. Rather, management efforts must be directed towards building flexibility, adaptability, and resilience to deal with elements of surprise that are considered as inherent and endemic features of ecosystems (e.g. Gunderson, Holling and Light 1995; Berkes and Folke 1998; Gunderson and Holling 2002).

There are parallels between ecologists' conclusions about ecosystem behaviour and Rose's conclusion about reflexive research practices. It is simply not possible to know all the permutations of power relations or to untangle the complex web of relationships in the research process. Furthermore, Rose suggested that researchers must admit the gaps and holes in our understandings as we reflect on our own research practices. But ecologists' work moves beyond this conclusion. Rather, reflexive research practices should attempt to

identify when and how to adapt research methods to meet unexpected outcomes. Such a position challenges the notion of danger itself. We emphasise this point because we believe it is key. Our interventions – in this case, our own research practices – can be designed for learning and adaptation *throughout* the research process.

Building adaptive and resilient research practices

Our argument for adaptive research practices is congenial to the philosophy of adaptive environmental management. It suggests that human intervention need not be tentative and fearful of mistakes; rather interventions can be designed for learning (Lee 1993; Gunderson, Holling and Light 1995; McLain and Lee 1996; Walters 1997; Berkes and Folke 2002; Gunderson and Holling 2002). Using an adaptive approach means that adjustments can be made, learning occurs, and future initiatives can be based on the new understanding. In this way, strategies for ecosystem management have corollaries for the development of resilient and adaptive research practices. Four components of adaptive management provide suggestions for research practices:

- preparing for surprise,

- involving diverse research participants,

- reconsidering the role of researcher, and

- redefining research success.

We provide detailed examples of these practices in vignettes contained in text boxes. These illustrative vignettes provide opportunities for critical reflection and debate rather than 'answers' to issues raised in the paper.

Preparing for surprise

> I would like to see us devise methods and methodologies that maximise the chance that we will see things we were not expecting to see, that leave us open to surprise, that do not foreclose the unexpected, …to…avoid…simply affirm[ing] what we already believe (Hanson 1997, 125).

In this quotation, Susan Hanson suggested building a research practice that welcomes the unpredictable. Constructing a research practice this way builds in a capacity for learning and adaptation, because "surprises," or unexpected findings or responses are seen as opportunities to learn from, rather than as failures to predict or avoid.[7] All parts of the project are viewed as experimental, in the sense that all parts should be evaluated and modifiable in the light of feedback that suggests that changes are needed. This approach emphasises "learning by doing" and the progressive accumulation of knowledge (Berkes and Folke 1998, 11). This is not a strategy of accumulating knowledge through the application of "normal" science (Kuhn 1962). Rather, we are suggesting that each research project can be designed as an experiment in adaptation, wherein learning proceeds throughout each stage of research, not only as results are interpreted following data

---

[7] Ian Cook and Mike Crang (1995, 4) for example, note the "surprising twists and turns" which ethnographic work can take, and they recommend that these contingencies be incorporated and built on, in the research process.

gathering. There are parallels here to ethnography, various participatory approaches, and to grounded theory, all of which seek meaning and new learning through iterative approaches (Strauss and Corbin 1990; Herbert 2000; Pain and Francis 2003). However, the emphasis suggested here is to create experimental designs from the outset to advance learning.

How do we prepare for surprises in our research? One element involves being open to the possibility that our understanding or definition of a research problem may be inappropriate or partial (Vignette 1).[8] This does not mean that previous research does not contribute to expectations, or that researchers do not have to be concerned about educating themselves about a specific research topic and the way that others have approached or defined it. It does mean that researchers are open to, and actively seek, feedback about the expectations that they bring with them from their particular academic field. Had the project described in Vignette 1 been undertaken as an adaptive research process, the new perspective would have led the researchers to try to make more room for changes in direction, based on such "surprises" that emerged during the process of doing research.

Vignette 1: Designing research practice for surprise

In 1998, Evelyn was involved in a project on the decision-making processes of co-management committees established under the James Bay and Northern Quebec Agreement. Based on a review of available literature, both published and in a variety of reports, submissions to government bodies and other "grey" literature, the researchers expected that the structure of these committees would be foreign to Inuit representatives and that the Inuit would therefore be at a disadvantage. For example, they thought that language would be a problem, and that western decision-making processes would be at odds with Inuit decision-making practices. The interview questionnaire probed for these and other similar difficulties.

Imagine their surprise when one of the interviewees reacted quite strongly to these questions, stating clearly that these were "1960s questions" and that the researchers assumed that Inuit were unable to adapt to and perform effectively on these co-management committees.

This was a new perspective for the research team. The research design had not contemplated revision in mid-stream to reflect this change of lens. The response was to complete the scheduled research interviews, using the questionnaire they had designed initially, but to look for this kind of theme in the transcripts from other Inuit participants. Sure enough they found other similar expressions, although not stated as baldly.

Thoughtfulness about research strategies is another foundation for designing research for surprise. Hanson (1997, 120) argued that "new methodological horizons – and new questions and new understandings – are to be found through combining several different approaches to understanding, each of which alone affords only limited insights." Adaptive research methodology may mean continuously evaluating whether or not research strategies are producing the most accurate, useful, or creative possible results, and *a willingness to introduce other methods* if they are not. Thus, adaptive research may require researchers to draw on a wider range of methods than typically employed as an

---

[8] These examples build on Dennis Rondinelli's (1983, 93-4) description of types of experimental projects that are useful in adaptive management.

explicit strategy to expose unacknowledged assumptions and expectations in the research design. For example, Andrea Nightengale (2003) deliberately used diverse methodologies (in this case qualitative ethnographic techniques such as oral histories, participant-observation, and in-depth interviewing as well as aerial photo interpretation and quantitative vegetation inventory) to illustrate different facets of the story of forest change in Nepal. Her approach was not to use one set of data as background or context for the other, but rather to expose and explore the silences and incompatibilities as well as the regularities that emerged from juxtaposing each. While she did not document any changes in research strategies as she progressed, she did reflect critically on the gaps of each method and consequently, she identified limitations of each for understanding forest change.

Adaptation can also occur in the interpretation of research findings. Cathy Bailey, Catherine White and Rachel Pain (1999) pointed to the dual need for "critical thinking" and "reflexive response" that requires checking of key interpretations with research participants. This is far from being haphazard. Rather, it reinforces the importance of carefully documenting key research decisions through diaries and field notes (Bailey, White and Pain 1999; Baxter and Eyles 1999), and providing time for reflection (Massey 2002). For example, Ian Cook and Mike Crang (1995, 49) suggested that one reason why ethnographic researchers do serial interviews is to "allow time for researcher and researched alike to begin to think about, explore, and make sense of the contradictory, inconsistent and taken-for-granted natures of their/our everyday lives." Even the "writing-up" process, often viewed as something that happens after research is completed (Berg and Mansveldt 2000), can be viewed as an experimental process, open for feedback and revision.

In practice, we suggest that as research participants respond in unexpected ways and/or our research design fails to fit, we can use this information to go back to an earlier stage and modify our expectations and our strategies. For example, Geraldine Pratt (2000) illustrated how her revision of expectations led to new ways of viewing and legitimating forms of evidence (role plays) that had previously been buried. Adaptive research implies building in feedback mechanisms within and between stages, rather than viewing research activities as a linear chain of events that can be easily traced from their sources and to their end points. Unexpected events taking place during the research can be viewed as disturbances that give researchers opportunities to adapt to new information. Research practices that are openly improvisational and "experimental", while acknowledging uncertainty, are likely to offer new opportunities for learning.

Involving research participants

> A research team that incorporates diversity is also more prone, than is a
> single investigator to finding surprises…(Hanson 1997,126).

Hanson (1997,126) suggested involving multiple voices throughout the research process opens up the possibility for new insights. Hanson highlighted the ability of research collaborators who are students to bring fresh insights, referring to the impact of students on the data collected in her work with Pratt in Worcester (Hanson and Pratt 1995). Richard Howitt (2001) discussed the possibilities for new perspectives that emerge from engagement with students in a variety of settings. As Janice Monk, Patricia Manning and Catalina Denman (2003) noted recently, most research questions in human geography are

"defined by the single researcher and publications …appear in a single authorial voice." They suggested that collaboration represents an important contribution to feminist commitments to changing relationships between researchers and research subjects, and their paper details some of the challenges and benefits involved in collaborative research.

Because researchers do not have complete knowledge of the phenomena under investigation or the relationships involved, and because social processes unfold differently in different places, academic researchers can benefit from the insights of the people experiencing the phenomena being studied. In this context, "research subjects" become participants or collaborators. Two implications are to use methodologies that invite participation, and to build opportunities for learning into research process by encouraging participants to question researcher assumptions, definitions, and methods (Rondinelli 1983; Herbert 2000).

Development geographers (among others) have employed a variety of approaches that involve participants in defining elements in their lives that require change, in designing supporting research, and in effecting solutions (e.g. Chambers 1994a; 1994b; 1994c; Kapoor 2002; Kesby, Kindon and Pain 2003; Kindon 2003). Rachel Pain and Peter Francis (2003, 47) have recently suggested that these methodologies may be appropriate for critical human geographers concerned with improving people's lives through research. Our focus in this paper is slightly different. Part of the rationale for participatory approaches is the acknowledgement that participants often have critical insights into local situations that may escape researchers who are not community members, and that their involvement produces more effective strategies for change. Our argument builds on this insight to suggest that encouraging research subject participation can produce new insights and challenge dominant representations in a wide variety of social research projects.

We do not imply that all research participants inform the project in the same way, or that research participation takes the same form in all projects. Indeed, the degree of participation may vary along a continuum. At one end of the continuum is a project where participation is limited to the data collection stages, and where participants produce accounts of their experiences in their own words, but are less involved in defining projects or evaluating interpretations. At the other end of the continuum is the type of project where researchers and local stakeholders interact at the outset to define important questions, relevant evidence, convincing forms of argument (e.g. Berkes and Jolly 2001; Kindon and Latham 2002; Monk, Manning and Denman 2003). Emerging efforts on Aboriginal research protocols in Canada provide examples (Vignette 2). Somewhere in the middle are methodologies that ask participants to respond to and evaluate researchers' proposed frameworks for addressing and issues, use methods the draw out participants' perspectives, and ask participants for feedback on researchers' interpretation of results (for examples see Baxter and Eyles 1999; Kindon and Latham 2002; Cupples and Kindon 2003; Pain and Francis 2003).

We suggest these different locations on a continuum of participation because participants will vary in their capacity *and willingness* to contribute time and energy to research projects. As Pain and Francis (2003) found out in a participatory research project about young people, exclusion, and crime victimisation in Newcastle upon Tyne, England, it was difficult to engage participants in aspects of research beyond the data collection process. Indeed, given the immediate concerns of many of the participants with finding shelter, food, and employment, Pain and Francis (2003, 51) concluded that "a brief input to

a [data collection] session seems a major contribution, and to ask for more can seem morally dubious."

Vignette 2: Protocols and Principles for Conducting Research in an Aboriginal Context

Many Aboriginal communities in Canada have become increasingly concerned that research conducted with community members should reflect community interests and interpretations. These concerns emerge from a desire to make sure that analyses accurately reflect Aboriginal realities and the desire to ensure that communities benefit from research either through increased capacity or through answers to questions concerning communities. Collaboration can represent a rich opportunity for new insights and perspectives. To undertake her research, Evelyn is increasingly involved in negotiating research protocols with representatives of Aboriginal communities. These protocols vary in their levels of community involvement. The following example is an excerpt from the protocol suggested by the Indigenous Governance Program, University of Victoria, Victoria, Canada (2003).

"Where Indigenous people are major participants in research or they have a major interest in the outcome of a research project focused on an issue of relevance to Indigenous people, then working relationships based on collaboration and partnership should be established between the researcher and these participants. This would include the mutual sharing of research skills and research outcomes" (pp. 3-4).

"The researchers' main responsibility and accountability will be to the people involved in the activities being researched, who will be considered as having an equal interest in the project" (p. 6).

"The terms of the research as well as the research question and methodology will be designed in consultation with, and having due consideration for, the expertise of the Indigenous individuals or groups who will form part of the research" (p. 7).

"The researcher and the individual or group providing the information will share continual monitoring of the research process equally" (p. 7)

"As part of collaborative processes, the research initiator will take responsibility for sharing and co-developing research skills with research participants" (p. 7).

"The research will make a positive contribution to Indigenous needs, aims and aspirations as defined by Indigenous people and the enhancement of Indigenous values" (p. 7-8).

"The findings of the research will be presented in a format that is readily understandable and accessible to all stakeholders" (p. 8).

Furthermore, the emphasis in this paper is not on the degree of direct control that a variety of participants exert over the research process, but the way in which their participation is regarded throughout research stages. The very process of collaboration has the possibility of creating surprises and unexpected interpretations that challenge taken-for-granted ways of interpreting the phenomenon/a being studied. What is important is the sense that participants contribute to the production of knowledge; that is, we emphasise the significance, rather than the amount, of participants' contributions.

In summary, an adaptive approach to research is open to opportunities for self-organisation through mutual feedback and entrainment (Colding and Folke 1997). Like adaptive environmental management that emphasises feedback from the environment in shaping policy, adaptive research emphasises the agency of a variety of participants in shaping the research process. This means that the research process can be viewed as an iterative and co-evolutionary one, involving two-way and on-going feedback within the research team and between researcher and the researched during the research process. New information is brought forward or entrained into the next point in the research process. Through these experiences, a resilient relationship may develop that builds on the joint experiences generated by research practices, provided that there is memory and political will among researchers and research subjects to allow them to reorganise (Berkes and Folke 2002).

Reconsidering the role of the researcher

Pursuing this goal is likely to entail a letting go, a conscious attempt to relinquish control over the research process (Hanson 1997, 125).

A number of researchers, in addition to Hanson, have suggested that designing research processes that maximise the possibility that we will be "surprised" means lessening researcher control over the research process. Kindon and Latham (2002) showed that methods that recognise that participants are reflexive, productive agents can result in a process of negotiating interpretations that include disagreement, "incompleteness, indeterminacy and even inarticulateness," and that challenge a researcher's impulse to write over gaps and contradictions. In the paper that inspired the analysis here, Rose (1997) similarly invited researchers to identify the gaps and fissures in the production of knowledge, an act that illustrated the researcher's inability to control or interpret all of the meanings that are produced. Pratt (2000, 645) wrote about role-playing among her Filipina collaborators that produced data that were "simply out of [my] control." She (2000, 650) suggested that researchers might envision their work as performance and "take our role as improvisational directors both more lightly and more seriously, to create spaces from which to speak and perform the unspeakable."

At the same time, while approaches that emphasise the role of participants can help to undermine the authority of the researcher, they do not completely shift the power relationships that underlie the production of knowledge in academic disciplines. It is still most often researchers who initiate projects, define starting parameters, shape data collection and interpretation, and take the major role in writing up results. And we recognise that even in popular media, the power of authority on topical news and science subjects continues to rest with academics.

An ecological metaphor helps us to approach the implications of power from a different perspective. One of the major problems associated with the power of the academy has to do with how that power shapes interpretations to reflect the experiences and preconceptions of the researcher, rather than the reality of the participants (Howitt 2001). However, if the complexity and dynamics of social reality, like nature, mean that our understanding is never complete, then the power of the researcher and the effect this has on (mis)interpretation is only one of many elements that affect research outcomes. This does not mean that the issue of researcher power is trivial. It is not. It does mean, though, that our expectations shift. Instead of being paralysed by the unobtainable goal of ascribing and

eliminating the biases associated with the power of academic researchers, the emphasis can shift toward designing research processes that acknowledge their existence. These are processes that allow the researcher's role to be openly challenged and even de-stabilised, and that build in flexibility to respond to these challenges when they emerge (Vignette 3).

Vignette 3: Loosening control of collaboration

In a recent collaborative research proposal, Maureen discovered that community collaborators were not interested in writing or revising the research proposal. Two community collaborators agreed to serve as co-directors of the project. They offered to provide written comments on the draft proposal. But these comments did not come. Community collaborators later identified that academic applications required reference to

academic literature and used specialised jargon to make a proposal successful. Besides, they were busy – calving, seeding, keeping the books – Maureen received many emails about these activities. Over time, Maureen realised that the community collaborators had assumed a very strong division of labour. In this division of labour, it was Maureen's job to get the money. Furthermore, they wanted no say in the budget, beyond reinforcing some basic local needs. Nevertheless, collaborators participated at key junctures. They gave Maureen opportunities to meet local residents as well as those in national networks who were interested in the project. They wrote letters of support. They gave direction to key aspects of the concept and approach, even after deadlines had passed. For example, after the last meetings were held, and the proposal was all-but submitted, Maureen received new suggestions for research design one morning over a kitchen table and a cup of strong coffee. This kind of "in" and "out" involvement is likely to permeate further stages of the research and challenges all participants – academic investigators, graduate research assistants, community co-directors and participants – to account for the differing timing and means of collaboration.

For many academics – ourselves included – this is a scary thought. Yet, we suggest that the location of the researcher within the research process is not necessarily dangerous, requiring hyper-vigilance and/or fearful retreat. Instead, we might consider useful a metaphor of navigation as offered by Fikret Berkes, Johan Colding and Carl Folke (2003, 21), referring to the ability to "capture the dynamic process of building adaptive capacity." Jürgen Hagmann and Edward Chuma (2002, 27-28) found that facilitation skills were crucial in learning to navigate. In their words:

> Facilitation is about asking the 'right' questions at the 'right' time in order to enhance peoples' critical self-reflection, discovery and self-awareness without pre-empting the responses. Facilitators lead the process but not the outcome and direction. The major difficulty is the 'steering' of the facilitation process which means to recognise and empathise situations, moods, group dynamics etc. and react with the right question and pattern to it.

The literature on adaptive management emphasises the importance of creating environments where learning on the part of all participants can take place, and this may be one of the most important roles of the researcher as navigator.

Redefining research success

> Perhaps the most difficult part of adaptive management is the need to redefine success (Lee and Lawrence 1986, 431, quoted in Mitchell 1997)

Nowhere is this quotation more applicable than when creating adaptive and resilient research practices. Adaptive research means that the compilation of more or less definitive results, delivered at academic conferences, and published in refereed journals are not always the only or even the most important criteria for evaluating the success of the research. For example, the active involvement of participants means that expectations may be different and sometimes even contradictory. Participants may over or underestimate the ability of the researcher to effect changes (Vignette 4). What local communities need or expect from research (for example, writing reports that provide necessary data or products so communities can ask for funding from various government agencies) may take up large amounts of researcher time but not produce materials that researchers require for success in academic environments. Conversely, research that contributes to general knowledge about how society works may not go very far in meeting specific local needs (e.g. jobs, food). Expectations are even more complex when a variety of stakeholders is involved, including a mix of private/public funding bodies and various levels of government. Adaptive research means negotiating processes that attempt to meet a variety of needs at the same time. No doubt we, as academic researchers, will come away with less of a sense of clear accomplishment - we might even get resentful - as we try to meet those multiple needs/demands.

Adaptive research also might mean finding value in the *process* of doing research, as well in the production of results. For example, Jennifer England, a graduate student at UBC attempted to collaborate with Aboriginal groups on a project about urban Aboriginal youth.[9] The result was supposed to be a paper designed to meet the requirements of one of her Master's courses. The project was clearly of interest to urban Aboriginal organisations, but the process of negotiation took so long that there was no "research paper" to present when the course was over. Instead, England wrote a paper that documented her negotiations with Aboriginal organisations despite the fact that they had not "resolved" the research issue. She also questioned academic evaluations based primarily on written documents rather than the establishment of relationships with community organisations. This experience demonstrates the need to focus on process as much as traditionally defined research publication, and to emphasise forging relationships and building understanding as much as collecting data and writing research papers. And yet, can we expect that students will have the extended timeframe and political acumen to engage in such efforts? If not, how can we evaluate indeterminate outcomes of participation against more clear-cut efforts that might emerge from other student peers?

---

[9] Our thanks to Jennifer England who allowed us to share this story.

Vignette 4: Success or failure?

Below are three reflections from participants in a participatory research project conducted with Maureen in the late 1990s in British Columbia, Canada. The project examined the perspectives and activist strategies of women who supported industrial forestry in a region that had been subject to intensive international environmental campaigns. The dilemma for Maureen is multi-faceted. Maureen published a great deal of work from this research and enhanced her academic reputation. She established good (long term) relations with some of the participants and gross disappointments with others. Economic restructuring and government policies continue to marginalise the needs of forestry towns throughout the region. The decision of success or failure is still to be rendered.

During an interview, a 'community' interviewer from the study location and trained by Maureen, offered a much inflated view of academic influence on provincial policy.

Participant: Is that what's going to happen with this [research...be put on a shelf and ignored]?...I'm just curious.

Community Interviewer: I think Maureen has a personal interest, not a vested interest, but a personal interest in the results. I believe, from meeting her, that she has a real interest in this sort of thing and she has an incredible amount of valuable knowledge and I do believe that she's got, in her position as being professor at [The University of British Columbia], she's probably got a high, a tremendous amount of respect too ... . It's been my experience that people who are in educational institutions have credibility and knowledge and knowledge is power, so, you know. Hopefully, and as I say, she does have a personal interest in it, from the heart, not from [interrupted]

Participant: Perfect, that'll be good.

"Brenda", who later became a town councilor, was cited in the local newspaper, the *Squamish Chief*, 2000. In the newspaper interview, she never admitted that she had taken part in the project as a community researcher trained by Maureen and paid by the grant. Later that year, she used some of her background about the diversity of her community learned from the research to get elected. Instead, she is quoted as saying about the project:

"It didn't get anybody a full-time job, it didn't give a forest worker a job, it didn't contribute to the renewal of our forests."

This following text was an inscription on a gift to Maureen from North Island Women, Canada, 1999. Maureen was the keynote speaker for their local "Women of Influence" awards night.

"Thank you Maureen. Your concern is felt" .

After the project is 'complete', Maureen reflects: *"Neither my results nor my concern ever fed a family. They never gave a forest worker a job. Instead, I published a book and some articles. I got tenure and promotion."*

Conclusion

Establishing adaptive research practices faces many challenges. Some of these challenges are logistical in character. Adaptive practices require researchers to monitor their research constantly and to be sensitive to many players – ourselves, our research assistants, our community participants, even our funding agencies – on a regular basis throughout the process. Such oversight might require us to negotiate research design options and opportunities to address surprises that will inevitably arise. These efforts may require longer time horizons for research projects to allow for different logistical demands. Other challenges are institutional in character. Academics who pursue adaptive research may defy funding structures, ethics reviews, and expectations of performance (Cancian 1996; Monk, Manning and Denman 2003). It is difficult to establish "best practices" when adaptation means that conventional measures such as validity and reliability are founded on shifting sands of adaptive practice. For example, writing an application for a research grant that proposes that the applicant may deviate from the initial plans depending on early outcomes is more likely to be viewed as "disorganised" than strategic, honest, or insightful. This is particularly a challenge for less established scholars who have not acquired a strong track record and where admission of "limited knowledge" may be viewed as lack of skill. Ethics review panels are also unlikely to be favourable to a submission that suggests that the researcher may deviate from his/her research protocol as s/he discovers that initial methods do not bear anticipated results. We are not glib about these issues. They will not be easily addressed.

Nevertheless, both natural and social scientists are beginning to grapple with the limitations of knowledge and what this means for research practices. Designing a research project to be adaptive and resilient – by preparing for surprise, reconciling how we consider the involvement of community members, altering our role as researchers, and changing the definition of success – means that research is not dangerous because we fail to understand and reflect in a transparent way about our research roles. But it may be dangerous in other ways – especially with respect to the strategies, goals, and even the original premises of academic research practices.

Acknowledgements

References

Bailey, Cathy, Catherine White and Rachel Pain. 1999. Evaluating qualitative research: Dealing with the Tension between 'science' and 'creativity' *Area* 31, 169-179.

Baxter, Jamie and John Eyles. 1999. Prescription for qualitative research? Grounded theory in qualitative evaluation. *Area* 31, 180-181.

Berg, Lawrence and Juliana Mansvelt. 2000. Writing in, speaking out: Communicating qualitative research findings. In, Iain Hay (ed.), *Qualitative Research Methods in Human Geography*. Melbourne: Oxford University Press, pp. 161-82.

Berkes, Fikret, Johan Colding and Carl Folke (eds). 2003. *Navigating Social-ecological Systems: Building Resilience for Complexity and Change*. Cambridge UK: Cambridge University Press.

Berkes, Fikret and Carl Folke. 1998. *Linking Social and Ecological Systems.* Cambridge: Cambridge University Press.

Berkes, Fikret and Carl Folke. 2002. Back to the future: Ecosystem dynamics and local knowledge. In, Lance H. Gunderson & Charles Stanley (Buzz) Holling (eds.), *Panarchy: Understanding Transformations in Systems of Humans and Nature*. Washington, DC: Island Press, pp. 121-46.

Berkes, Fikret and Dyanna Jolly. 2001. Adapting to climate change: Social-ecological resilience in a Canadian Western Arctic community. *Conservation Ecology* 5, 18. http://www.consecol.org/vol5/iss2/art18

Botkin, Daniel B. 1990. *Discordant Harmonies: A New Ecology for the Twenty-first Century*. New York: Oxford University Press.

Cancian, Francesca M. 1996 Participatory research and alternative strategies for activist sociology. In, H. Gottfried (ed.) *Feminist Research Methods: Exemplary Readings in the Social Sciences*. Urbana and Chicago: University of Illinois Press, pp. 187-205.

Chambers, Robert. 1994a. The origins and practice of Participatory Rural Appraisal. *World Development* 22, 953-69.

Chambers, Robert. 1994b. Participatory Rural Appraisal (PRA): Analysis of experience. *World Development* 22, 1253-68.

Chambers, Robert. 1994c. Participatory Rural Appraisal (PRA): Challenges, potential and paradigm. *World Development* 22, 1437-54.

Colding, Johan and Carl Folke. 1997. The relations among threatened species, their protection, and taboos. *Conservation Ecology* 1, 6. http://www.consecol.org/vol1/iss1/art6

Cook, Ian and Mike Crang. 1995. *Doing Ethnographies.* London: Institute of British Geographers.

Cupples, Julie and Sara Kindon. 2003. Returning to university and writing the field. In, Scheyvens, R. & Storey, D. (eds.), *Development Fieldwork*. London: Sage. pp 217-231.

England, Kim. 1994. Getting personal: Reflexivity, positionality, and feminist research. *The Professional Geographer* 46, 80-9.

Falconer Al-Hindi, Karen and Hope Kawabata. 2002. Toward a more fully reflexive feminist geography. In, Pamela Moss (ed), *Feminist Geography in Practice: Research and Methods*, Oxford, UK and Malden, USA: Blackwell Publishers, pp. 103-115.

Flowerdew, Robin and David Martin (eds). 1997. *Methods in Human Geography: A Guide for Students Doing Research Projects.* Harlow: Longman

Gunderson, Lance H., Charles Stanley (Buzz) Holling and Steven S. Light (eds). 1995. *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York: Columbia University Press.

Gunderson, Lance H. and Charles Stanley (Buzz) Holling (eds). 2002. *Panarchy: Understanding Transformations in Systems of Humans and Nature*. Washington, DC: Island Press.

Hagmann, Jürgen and Edward Chuma. 2002. Enhancing the adaptive capacity of the resource users in natural resource management. *Agricultural Systems* 73, 23-39.

Hanson, Susan. 1997. Introduction to Part 2: As the world turns: New Horizons in feminist geographic methodologies. In, John Paul Jones III, Heidi Nast, and Susan M. Roberts (eds.), *Thresholds in Feminist Geography.* Lanham, MD: Rowman & Littlefield, pp. 119-128.

Hanson, Susan and Geraldine Pratt. 1995. *Gender, Work and Space*. New York: London.

Haraway, Donna J. 1991. Situated knowledges: The science question in feminism and the privilege of partial perspective. In, Donna J. Haraway, *Simians, Cyborgs and Women*. New York: Routledge, pp. 183-201.

Herbert, Steve. 2000. For ethnography. *Progress in Human Geography* 24, 550-568.

Holling, Charles Stanley (Buzz). 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4, 1-23.

Holling, Charles Stanley (Buzz) (ed). 1978. *Adaptive Environmental Assessment and Management*. Chichester/New York: John Wiley.

Holling, Charles Stanley (Buzz). 1986. The resilience of terrestrial ecosystems: Local surprise and global change. In, William C. Clark & Robert E. (Ted) Munn (eds.), *Sustainable Development of the Biosphere.* New York: Cambridge University Press, pp. 292-317.

Holling, Charles Stanley (Buzz). 1995. What barriers? What bridges? In, Lance H. Gunderson, Charles Stanley (Buzz) Holling, & Steven S. Light (eds.), *Barriers and Bridges to the Renewal of Ecosystems and Institutions*. New York: Columbia University Press, pp. 3-34.

Holling, Charles Stanley (Buzz). 2000. Theories for sustainable futures. *Conservation Ecology* 4, 7. http://www.consecol.org/vol4/iss2/art7/index.html

Howitt, Richard. 2001. Constructing engagement: Geographical education for justice within and beyond the tertiary classroom. *Journal of Geography in Higher Education* 25, 147-166.

Indigenous Governance Program. 2003. Protocols and Principals for Conducting Research in an Indigenous Context. University of Victoria: Faculty of Human and Social Development. Available online at:
http://web.uvic.ca/igov/research/index.html

Jackson, Peter. 1985. Principles and problems of participant observation. *Geografiska Annaler Series B. Human Geography* 65, 39-46.

Kapoor, Ilan. 2002. The devil's in the theory: A critical assessment of Robert Chambers' work on participatory development. *Third World Quarterly* 23, 101-17.

Katz, Cindy. 1994. Playing the field: Questions of fieldwork in geography. *The Professional Geographer* 46, 1, 67-72.

Keith, Michael. 1992. Angry writing: (Re)presenting the unethical works of the ethnographer. *Environment and Planning D: Society and Space* 10, 551-68.

Kesby, Mike, Sara Kindon and Rachel Pain. 2003. 'Participatory' approaches and diagramming techniques. In, Flowerdew, R. & Martin, D. (eds.), *Methods in human geography: a guide for students doing a research project.* 2nd edition. London: Longman.

Kindon, Sara. 2003. Participatory video in geographic research: A feminist practice of looking? *Area* 35, 142-153.

Kindon, Sara and Alan Latham. 2002. From mitigation to negotiation: Ethics and the geographic imagination in Aotearoa/New Zealand. *New Zealand Geographer* 58, 1, 14-22.

Kobayashi, Audrey. 1994. Coloring the field: Gender, "race," and the politics of fieldwork. *The Professional Geographer* 46, 1, 73-80.

Kuhn, Thomas S. 1962. *The Structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Lee, Kai N. and Jody Lawrence. 1986. Adaptive management: Learning from the Columbia River basin fish and wildlife program. *Environmental Law* 16, 431-60.

Lee, Kai N. 1993. *Compass and Gyroscope: Integrating Science and Politics for the Environment.* Washington, DC: Island Press.

Limb, Melanie and Claire Dwyer (eds). 2001. *Qualitative Methodologies for Geographers: Issues and Debates.* London: Arnold.

Ludwig, Donald, Ray Hilborn and Carl Walters. 1993. Uncertainty, resource exploitation and conservation: Lessons from history. *Science* 260, 17-36.

Massey, Doreen. 2002. Editorial: Time to think. *Transactions, Institute of British Geographers* 27, 259-261.

McDowell, Linda. 1992. Doing gender: Feminism, feminists and research methods in human geography. *Transactions, Institute of British Geographers* 17, 399-416.

McDowell, Linda. 1993a. Space, place and gender relations: Part I. Feminist empiricism and the geography of social relations. *Progress in Human Geography* 17, 157-79.

McDowell, Linda. 1993b. Space, place and gender relations: Part II. Identity, difference, feminist geometries and geographies. *Progress in Human Geography* 17, 305-18.

McLain, Rebecca J. and Robert G. Lee. 1996. Adaptive management: Promises and pitfalls. *Environmental Management* 20, 437-48.

Miles, Miranda and Jonathon Crush. 1993. Personal narratives as interactive texts: Collecting and interpreting migrant life-histories. *The Professional Geographer* 45, 84-95.

Mitchell, Bruce. 1997. *Resource and Environmental Management*. Harlow, England: Longman.

Momsen, Janet. 1993. Introduction. *Geoforum* 24, 1-4.

Monk, Janice, Patricia Manning and Catalina Denman. 2003. Working together: Feminist perspectives on collaborative research and action. *ACME: An International E-Journal for Critical Geographies* 2, 91-106.

Moss, Pamela, John Eyles, Isabel Dyck and Damaris Rose. 1993. Focus: Feminism as method. *The Canadian Geographer* 37, 48-61.

Nast, Heidi. 1994. Opening remarks on "women in the field.". *The Professional Geographer*, 46, 1, 54-66.

Nelson, Lise. 1999. Bodies (and spaces) do matter: The limits of performativity. *Gender, Place and Culture* 6(4), 331-353.

Nightengale, Andrea. 2003. A feminist in the forest: Situated knowledges and mixing methods in natural resource management. *ACME: An International E-Journal for Critical Geographies* 2, 77-90.

Pain, Rachel and Peter Francis. 2003. Reflections on participatory research. *Area* 35, 46-54.

Pratt, Geraldine. 2000. Research performances. *Environment and Planning D: Society and Space* 18, 639-51.

Pratt, Geraldine and Elia Kirby. 2003. Performing nursing: BC Nurses' Union theatre project. *ACME: An International E-Journal for Critical Geographers* 2, 14-32.

Rees, Judith. 1990. *Natural resources: Allocation, Economics and Policy* (2nd edition). London: Routledge.

Resilience Alliance. 2002. What is resilience? Resilience defined. *Resilience Alliance: Research on resilience in social-ecological systems – a basis for sustainability*. Last accessed 19 April 2004. http://www.resalliance.org/ev.php?URL_ID=1004&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1060817210&PHPSESSID=6d1bf83897b8519e1601ad09775c43f9

Rondinelli, Dennis A. 1983. *Development Projects as Policy Experiments: An Adaptive Approach to Development Administration*. London/New York: Methuen.

Rose, Gillian. 1993. *Feminism and Geography: The Limits of Geographical Knowledge*. Minneapolis: The University of Minnesota Press.

Rose, Gillian. 1997. Situating Knowledges: Positionality, reflexivities and other tactics. *Progress in Human Geography* 21, 305-20.

Schumacher, Ernst F. 1973. *Small is Beautiful: A study of Economics as if People Mattered*. London: Blond and Briggs.

Staeheli, Lynn A. and Victoria A. Lawson. 1995. Feminism, praxis and human geography. *Geographical Analysis* 27, 321-38.

Strauss, Anselm and Juliet Corbin. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, California: Sage Publications.

Walters, Carl. 1997. Challenges in adaptive management of riparian and coastal ecosystems. *Conservation Ecology* 1, 1-21.