


Collaborating with qualitative researchers to co-design social-ecological studies

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Abstract In recent years, ecologists have embraced the human dimensions of their discipline and expanded their remit to explore issues traditionally addressed by the social sciences and environmental humanities. This expansion offers opportunities to engage with diverse methodologies, some of which challenge the orthodoxies of conservation research; however, ecologists do not have the expertise to use social science methodologies in their work. In this Toolkit, we outline ways to improve social-ecological research and outcomes through partnerships with qualitative researchers. Ecologists – who lack the epistemological and methodological preparation needed for productive qualitative or mixed methods study design – have often used quantitative methods to investigate social-ecological systems. Though this has enhanced our ecological knowledge and led to the development of evidence-based conservation practices, the biodiversity crisis continues to worsen as a result of human behaviours. Qualitative inquiry offers powerful insights into the drivers of social and behavioural phenomena but remains under-represented in ecological research despite its broadening demographic. This presents a substantial missed opportunity that warrants rectifying. Here, we outline the qualitative research paradigm and highlight its benefits to ecology and ecologists. We also discuss a range of pitfalls and caveats ecologists encounter by not using appropriate qualitative research designs to support the exploration of their questions. We conclude by providing guidance for ecologists who intend to conduct research embracing qualitative or mixed paradigm designs. In order to address the human dimensions of ecology and conservation, it is essential to engage qualitative experts within and beyond the ecological science community. When fruitful collaborations form, research teams are able to approach some of ecology's most challenging problems from new perspectives, incorporating the views and knowledge of stakeholders on whom we rely for success.

Key words: collaborative, inductive, interdisciplinary, methods, mixed, qualitative, social.

INTRODUCTION

Ecologists are increasingly expected to grapple with the human dimensions of our discipline, whether this relates to changing attitudes towards nature (Davis *et al.* 2019; Taylor *et al.* 2020), using citizen science to drive data collection (Aplin *et al.* 2021), assessing the understanding of human activities (Miller 2005) or finding ways to encourage broader engagement with conservation and conservation actions (Bonney *et al.* 2009). Accordingly, the field of ecology has broadened 'beyond biology' (Teel *et al.* 2018) to include approaches to understanding human behaviour from the social sciences (Bennett *et al.* 2017a). Currently, ecologists without training in social sciences but with access to survey tools have produced a burgeoning body of poor-quality research (see Teel *et al.* 2018). Yet whilst social-ecological

studies using quantitative methods have started to feature prominently among the pages of ecology journals, qualitative research remains under-represented (Moon *et al.* 2016). This discrepancy represents a missed opportunity, as qualitative research provides direct insight into the motives behind human behaviours by delving into individuals' perceptions and understandings about the world (Given 2016). By addressing these motives, ecologists can better foster proenvironmental behavioural changes.

There is an urgent need for the discipline of ecology to embrace qualitative methods and include them in our methodological toolkit. Given ecologists' lack of training in these methodologies, the most effective way to embrace qualitative methods is through collaboration with social scientists who have qualitative expertise. Current species extinction rates are unprecedented in human history (Ceballos *et al.* 2015), despite more than three decades of work in the 'crisis discipline' of conservation biology

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(Soulé 1985). In essence, the biodiversity crisis that is the focus of much ecological research is a crisis of human behaviour (Schultz 2011; Swim *et al.* 2011). By engaging with qualitative social science, ecologists can illuminate understandings of the human-controlled drivers behind ecological degradation, conservation and restoration.

The quantitative methods ecologists often use to investigate the social side of social-ecological systems treat humans like any other study species – that is as passive subjects of scientific scrutiny, rather than active participants with an ability to provide rich accounts of their own lives (St. John *et al.* 2014). Instead of overlooking these accounts or simply reducing them to countable fragments, qualitative methods preserve the complexities and contextual details provided by research participants. In this way, qualitative methods have provided critical means to document evidence and engage with people across a range of disciplines (such as sociology, education and public health) for several decades. If ecologists are genuine in our commitment to understanding human behaviour by ‘mainstreaming’ the social sciences in ecology and conservation (Bennett *et al.* 2017b), the field must embrace qualitative research fully. This paper provides ecologists with a practical guide to increase their understanding of the caveats and pitfalls when incorporating qualitative designs in ecological research.

In this Toolkit paper, we aim to introduce the *Austral Ecology* readership to ways of engaging with colleagues and co-designing social-ecological research. As Toolkit papers are intended to be ‘instructional papers’, we present an overview of key principles of qualitative research to educate ecological researchers, particularly those with no prior experience with or awareness of qualitative methodologies and methods.

WHAT IS THE QUALITATIVE PARADIGM?

Qualitative research is a human-focused undertaking, which aims to delve deeply into people’s experiences, perceptions, behaviours and beliefs (Given 2016). This is complementary to quantitative paradigmatic approaches that document the facts (i.e. who, what, where, how many, etc.), without providing a deep understanding of *why* people do what they do. Qualitative research investigates societal processes and the meanings people make of phenomena, facilitating our understanding of how people think and how this affects their actions (Given 2016). Research designs draw on various methodologies (e.g. grounded theory; phenomenology; hermeneutics) and methods (e.g. interviews; focus groups; participant observation), that have been developed since the early years of the 20th century (Given 2008). This rich history of

qualitative inquiry is deeply embedded across many disciplines, and its approaches are used to study phenomena of interest across a broad range of experiences, diverse and complex settings, and people of varied backgrounds, worldviews and ages (Denzin & Lincoln 2011). Thus, qualitative scholars are well-positioned to collaborate with ecologists on interdisciplinary projects requiring a refined understanding of human behaviour, values, knowledge and attitudes.

Engaging with qualitative research practices may require a significant shift in mindset and philosophy for ecologists. It typically involves moving away from deductive approaches founded in hypothesis testing, towards more inductive approaches represented in qualitative paradigms (Fig. 1). While this could be viewed as a daunting departure from classical scientific methods, the shift may be less dramatic than expected. Many strands of ecological research are already grounded in an inductive approach, given the widespread adoption of research philosophies focused on deriving patterns from big data, forecasting/modelling and expert elicitation (Westgate *et al.* 2020). However, even these modes of quasi-inductive ecological research do not illuminate the contextual realities of human experience – that is, *why* people do what they do and what that means to foster change in society.

In practice, the value of qualitative research becomes immediately apparent when the information sought from stakeholders eludes capture by quantitative methods. ‘Closed-response’ surveys are so named for good reason – that is, respondents are only able to express themselves within tight, pre-defined boundaries (e.g. Likert-type scales) set by the researcher. Qualitative designs, on the other hand, are responsive to participants’ understandings of the phenomena under study and are (re)designed (*a posteriori*) for inductive analyses. If the intention of a study is to gain an in-depth understanding of people’s perspectives, rather than their quantifiable responses to a set of prompts that may or may not be personally meaningful, questionnaires are inappropriate tools with a limited value for the job (Newing 2010). Instead, qualitative methods enable researchers to collect richly detailed and contextualized accounts of people’s lives, via verbal or textual information (e.g. stories, histories, descriptions), as well as visual (e.g. photographs, drawings) or even numerical data. In interviews, participants focus on what they think is important or relevant, often highlighting issues that researchers may not have initially considered given their separation from the daily practices and experiences of those being studied (Young *et al.* 2018). Qualitative research also draws on a wealth of theoretical approaches across disciplines to inform analytic

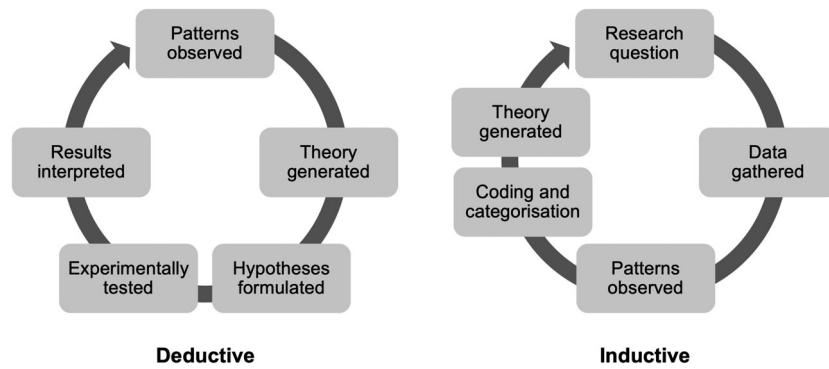


Fig. 1. Deductive and inductive approaches to research. Adapted from Underwood (1997) and Given (2016).

approaches (Collins & Stockton 2018; Leavy 2020; Lester *et al.* 2021).

It is important to note that qualitative writing styles differ markedly from those typically seen in quantitative social sciences and ecological publications. For example, it is typical for qualitative researchers to include a section in each paper outlining their philosophical positions (encompassing ontology, epistemology and methodology) so readers can judge the credibility and transferability of their results (see Moon *et al.* 2016). Qualitative researchers also integrate results and discussion sections in their papers, which are typically longer than quantitative research reports (e.g. by virtue of including quotes from in-depth interviews). These features may not fit stylistic publishing norms typically adopted in ecology journals.

WHY DO WE NEED QUALITATIVE RESEARCH IN ECOLOGY?

Throughout the early history of ecology, there was little perceived need to interview people – or, indeed, to consult them at all – regarding the understanding and management of biodiversity. The predominant approach of ecologists was to protect ‘wilderness’ areas by locking people out (Newing 2010). In contrast, today’s ecological professionals recognize that participatory approaches are imperative to successful conservation, developing Theories of Change (ToC) to ensure management strategies are effective (e.g. Biggs *et al.* 2017). The recent transition into an era of stakeholder engagement and co-management of social-ecological systems has placed social science methods on the research agenda (Bennett *et al.* 2017a), to the benefit of conservation science (Vadrot *et al.* 2018). If ecologists wish to investigate stakeholders’ knowledge in their study systems, it is important to co-design projects with experts in qualitative research to understand what and how people

think. It is also essential to work closely with the people who live and work in these systems, especially Indigenous and local communities.

The recent case of ungulate poaching in Golestan National Park, Iran (Ghoddousi *et al.* 2017), is an insightful example. There, researchers used quantitative ecological methods to determine the abundance of four ungulate species. However, quantitative questionnaires were deemed inappropriate for studying poaching behaviours (Ashayeri & Newing 2012); the local people were reluctant to report illicit activity on paper to persons unknown, and the researchers did not understand *a priori* all the possible motives for poaching. They built mutual trust with poachers through collaboration on joint wildlife monitoring programmes, securing participation in additional research projects by transparently discussing the scope and purpose of each one (Ghoddousi *et al.* 2017). A constructivist approach was used to account for poaching from multiple perspectives, which were elicited during semi-structured interviews and analysed using grounded theory. This qualitative approach enabled researchers to determine that the local people poached ungulates for subsistence, pleasure, tradition and/or profit, as well as out of spite for conservation bodies (Ghoddousi *et al.* 2017). Poaching caused ungulate populations to decline despite legal protection. After working with local communities to identify the motivators of poaching, researchers were able to recommend strategies for reversing the decline that worked within pre-existing incentive structures rather than against them.

Qualitative and mixed research approaches are essential to furthering our comprehension of social-ecological systems. Qualitative researchers draw on a range of methods (e.g. interviews, focus groups, personal diaries, photographs) and from various data sources (e.g. websites, policy documents, social media posts, archives). A primary focus of qualitative designs is to select and triangulate multiple sources of research evidence within each project, which can

be of great benefit to ecological research designs and outcomes (Given 2016).

WHERE IS THE QUALITATIVE RESEARCH IN ECOLOGY?

Despite its utility, qualitative research has been perceived within the biological science community as being less rigorous than quantitative research (Sandbrook *et al.* 2013). Relatively few ecological studies employ qualitative methods (Drury *et al.* 2011), a pattern of practice that likely reflects a cultural norm regarding the legitimacy of knowledge in the biological sciences (Eigenbrode *et al.* 2007) and a legacy of ecologists primarily dealing with nonhuman species. Even though the term ‘ecology’ (Gr. οἶκος + – λογία) literally refers to the study of households, which include humans, most ecologists have been trained exclusively as biologists (Adams 2007). Biological research is almost entirely quantitative in nature, so ‘most biologists are initially extremely resistant to the idea that anything other than numbers should be regarded as data; it goes against all their training’ (Newing 2010, p. 8).

Training in a particular field with deference to others instills disciplinary specialists with a clearly defined ‘conceptual scheme’ that can go unchallenged so long as they remain within their domain of study (Eigenbrode *et al.* 2007). Throughout their training, specialists are conditioned to accept a series of philosophical assumptions about the nature of reality (ontology) and how knowledge of that reality is created (epistemology), which inform methodological choices (see Moon & Blackman 2014). They rarely study philosophies of science beyond their own discipline’s traditions, leading to the false notion that a particular way of doing and judging scientific work is the only legitimate one (Williams & Gordon 2015). For example, a conservation biologist might criticize a qualitative researcher for not producing generalisable results (Rust *et al.* 2017), despite the fact that generalisability is not an appropriate outcome for qualitative research (where the goal is *transferability* of results) (Given 2016). This is tantamount to judging a fish by its ability to climb a tree. We must take a broader view in order to recognize this issue; yet, until recently, there has been no incentive for biology-trained ecologists to think outside their philosophical box (Drury *et al.* 2011). Despite some moves towards interdisciplinarity in higher education, many disciplinary silos remain entrenched in our curricula, in the design of our universities, and the ways research is assessed and rewarded (Arnold *et al.* 2021). We are incentivized to work within traditional boundaries of what constitutes a discipline, while we speak of our desire for interdisciplinarity

(Jacob 2015). The result is that interdisciplinary and mixed paradigm research designs may have significant costs for early- and mid-career researchers (Schuitema & Sintov 2017).

WHEN DID QUALITATIVE METHODS BECOME SO RELEVANT?

Despite great diversity within the ranks of conservation (Sandbrook *et al.* 2011), the philosophical position of (post) positivism has been dominant in ecological science (Moon *et al.* 2016) and the natural sciences, generally, for centuries (Williams & Gordon 2015). This perspective presumes that researchers can know ‘the truth’ (i.e. a singular reality) via an unbiased application of the scientific method, which involves objective empirical observation and deductive reasoning (Evely *et al.* 2008; Moon & Blackman 2014). It is this orientation that leads natural scientists to privilege some methods – particularly quantitative methods – over others, by default (Evely *et al.* 2008). Positivism has been favoured across many academic disciplines for good reason: it works. When it comes to investigating physical, chemical, or biological phenomena, positivist science wields substantial explanatory power.

Social systems, however, have proven to be difficult objects of study within a positivist framework by virtue of their complexity and the subjective nature of the reasoning that drives human behaviour (Evely *et al.* 2008; Moon & Blackman 2014). Positivism is incompatible with the notion that two people can imbue the same object or phenomenon with different meanings, based on distinct understandings of their world(s) (Crotty 1998). Problems arise in policy and practice where the seemingly incontestable ‘objective’ knowledge of positivist discourse is used, for example, to seize power or to marginalize Indigenous and/or local knowledge (Price 2016). Thus, if ecological science is to continue moving ‘beyond biology’ and into the social realm (Teel *et al.* 2018), ecologists must move beyond positivism in their research designs. Qualitative research – which is informed, for example, by postmodern and poststructural theories – offers a range of rigorous methodological approaches (Given 2016). These may require dramatic shifts in worldviews held by ecologists owing to the values and mindsets that are embedded in their training and experiences.

As ecology increasingly integrates human perspectives into its framework, the ways in which ecologists can benefit from human-focused research practices become apparent. For example, the early adoption of citizen science by ecologists (Silvertown 2009) and the rising number of citizen science projects in ecology (Hall *et al.* 2021) create an imperative to better

engage with non-specialists, especially given rising concerns over data quality in these projects (see Lukyanenko *et al.* 2016). The desire to translate ecological research to evidence-based practice (Colloff *et al.* 2017) would also be enhanced by developing collaborations with researchers in disciplines such as health and education, using qualitative methods to highlight how the values and actions of practitioners drive successful outcomes in ecological systems.

CAVEATS AND PITFALLS WHEN ADOPTING QUALITATIVE APPROACHES

Over recent years, ecologists have embraced qualitative *questions* to broaden their understanding of community values, knowledge and attitudes. However, they are not using appropriate, qualitative research *designs* to support the exploration of these questions, in partnership with qualitative research experts (Young *et al.* 2018). Ecologists must partner with appropriately trained qualitative experts to be successful in exploring these research questions. Qualitative research designs enable us to study social phenomena that defy quantification, thereby shedding light on drivers of social-ecological change that have previously been explained simplistically or ignored entirely (Newing 2010). When undertaking research in a field that has been dominated by quantitative approaches, we can ask different questions and/or attack intractable problems from a new research angle using qualitative designs. This is not to say that every ecologist should put down their tools, abandon their previous training and start designing qualitative research programs. On the contrary, we encourage those ecologists interested in social questions to partner with qualitative social scientists to co-design these projects. When a researcher embraces ‘the misconception that any biologist can do a social survey’ (Teel *et al.* 2018, p. 7) and engages in research practices for which they are untrained, not only are they committing an act of scientific imperialism (Brister 2016), they are also dismissing qualitative researchers’ expertise in complex data-gathering and analytic skills. Social scientists must therefore be embedded as full partners in collaborative teams (Given 2016).

Those who are not trained in the social sciences often misuse qualitative methods, to the detriment of their research (Sutherland *et al.* 2018); research that is poorly executed is easily dismissed, which can (unfortunately) harm the reputation of otherwise rigorous and appropriate qualitative approaches (Young *et al.* 2018). This adds fuel to the fire for those researchers who are dismissive of qualitative approaches and/or those who are ignorant of qualitative measures of rigour.

One additional pitfall for those willing to engage with different methodologies and epistemologies emerges when diving into new literature. A common theme for any researcher moving into interdisciplinary work is that ‘terminology and writing styles can make publications effectively incomprehensible, or at least deeply unattractive and difficult, for people trained in a different discipline’ (Sandbrook *et al.* 2013, p. 1487), seemingly regardless of which discipline you are coming from, and which you are reading.

FIRST STEPS FOR ECOLOGISTS: COLLABORATE WITH QUALITATIVE EXPERTS ACROSS DISCIPLINES

When considering qualitative research, ecologists must engage with qualitative experts and embark on collaborative study designs (Given 2016). Collaboration is required for all members of an interdisciplinary research team to understand each other’s work and draw on each other’s expertise (Newing 2010). While on the surface this seems like a simple and genial prospect, in reality, it is easier said than done, as social and natural scientists tend to ‘ask different kinds of questions, employ different methods, collect different kinds of data, use different analytic tools and produce different kinds of outputs’ (Strang 2009, p. 5). Too often, one approach takes *de facto* dominance over the other (Popa & Guillermin 2017), through a gradual and sometimes imperceptible process known as disciplinary capture (Brister 2016). This is problematic because sound interdisciplinary research needs to be rigorous on both sides of the disciplinary divide (Harrison *et al.* 2008).

Whilst interdisciplinary teams may dismiss issues like disciplinary capture as the unavoidable result of ‘communication problems’, they actually result from unaddressed philosophical differences (Eigenbrode *et al.* 2007; O’Rourke & Crowley 2013; Brister 2016). Fortunately, interventions involving deliberate philosophical dialogue have been designed to assist researchers in overcoming such issues (see Eigenbrode *et al.* 2007; O’Rourke & Crowley 2013).

This is not to say that every researcher in every team must possess both generalist and specialist expertise; rather, each member ‘must understand enough about the different approaches to be able to communicate with one another professionally across disciplinary boundaries’ (Newing 2010, p. 14). What ecologists should aim for is expertise across a research team, with all the component members being conversant – but not necessarily masterful – in the philosophies and associated methods of their

collaborators. Once this has been established, *bona fide* interdisciplinary research can result.

Currently, what many researchers call ‘mixed methods’ studies are often quasi-mixed, meaning that both qualitative and quantitative data are collected, but there is little to no integration of the two (Alise & Teddlie 2010). In such studies, qualitative components typically take a back seat to the quantitative designs (Baškarada & Koronios 2018). For example, a researcher might tack an open-ended question onto the end of a questionnaire and (wrongly) assume this constitutes a mixed-methods study (Given 2016; Given 2017). This is problematic because a rigorous mixed-methods study involves the integration of philosophies (Fetters & Molina-Azorin 2017); to focus on methods alone is to put the ‘cart before the horse’ in research design (Hesse-Biber 2010). As a result, some authors have suggested we do away with ‘mixed methods’ as a term, proposing ‘mixed paradigms’ (Given 2017) or simply ‘mixed research’ (Johnson *et al.* 2007) as alternatives. Whatever the nomenclature, truly mixed research is more likely to result from a healthy collaborative partnership between qualitative and quantitative researchers than from any one person or team working in isolation, trying to adopt another’s practices without appropriate expertise.

SEEK APPROPRIATE EXPERTISE FROM OUTSIDE ECOLOGY

Those hoping to learn more about qualitative research must look to the pantheon of academic disciplines that generate works of ecological social science (Bennett *et al.* 2017a). Disciplines such as environmental sociology and environmental education have long histories of qualitative research practice, creating a rich vein from which newly minted social-ecological scientists can draw information, inspiration and potential collaborators. Likewise, researchers in human ecology and environmental psychology are experienced in straddling the ‘social’ and ‘ecological’ in social-ecological systems. It is encouraging to see more and more tertiary institutions exposing their undergraduate science majors to these bodies of knowledge through interdisciplinary or transdisciplinary programming (Andrade *et al.* 2014; Kelley *et al.* 2019). Simultaneously, masters and doctoral programs that effectively integrate teaching and learning across multiple faculties have emerged (Batterbury & Toscano 2018; Francis *et al.* 2018). This creates opportunities for graduates to familiarize themselves with diverse disciplinary norms whilst learning a common language through collaborative ventures, meaning they are better

positioned to engage in professional interdisciplinary research environments.

RECOMMENDATIONS FOR ECOLOGICAL RESEARCHERS

To ensure qualitative approaches are adequately represented in ecology, we need more than inspired researchers; we need ecologists to be open to developing interdisciplinary research teams and partnering with qualitative experts to together solve human-focused ecological research problems. At present, even those ecologists who are working across disciplines may be engaging in multidisciplinary groups that retain paradigmatic silos, rather than embracing a team-based approach designed to weave together different research approaches and build something new. The value of interdisciplinary research is that each discipline can contribute to and learn from the other, thus achieving research goals that otherwise could not be accomplished separately.

There are many practical steps that ecologists can take to develop successful interdisciplinary teams:

Widen our worldviews and identify how understanding the human dimensions of our study systems are central to answering many of the questions we ask in ecology, for example, read:

- ‘The foundation of social research: Meaning and perspective in the research process’ by Michael Crotty (1998),
- ‘Social constructionism’ by Vivien Burr (2015), and
- ‘100 questions (and answers) about qualitative research’ by Lisa Given (2016).

Recognize that quantitative ecological research training is insufficient for the study of human-focused research problems, for example,

- Further our training and understanding through the International Institute for Qualitative Methodology (IIQM), or
- The Australian Consortium for Social and Political Research Incorporated (ACSPRI).

Broaden our networks to break down disciplinary silos and find qualitative researchers with shared research interests:

- Invite qualitative researchers to present at seminars and departmental meetings to share information on their research designs;
- Invite interdisciplinary colleagues to conferences, for example, plenary (maximize exposure), organize mixed paradigm symposia and/or conduct introductory training workshops.

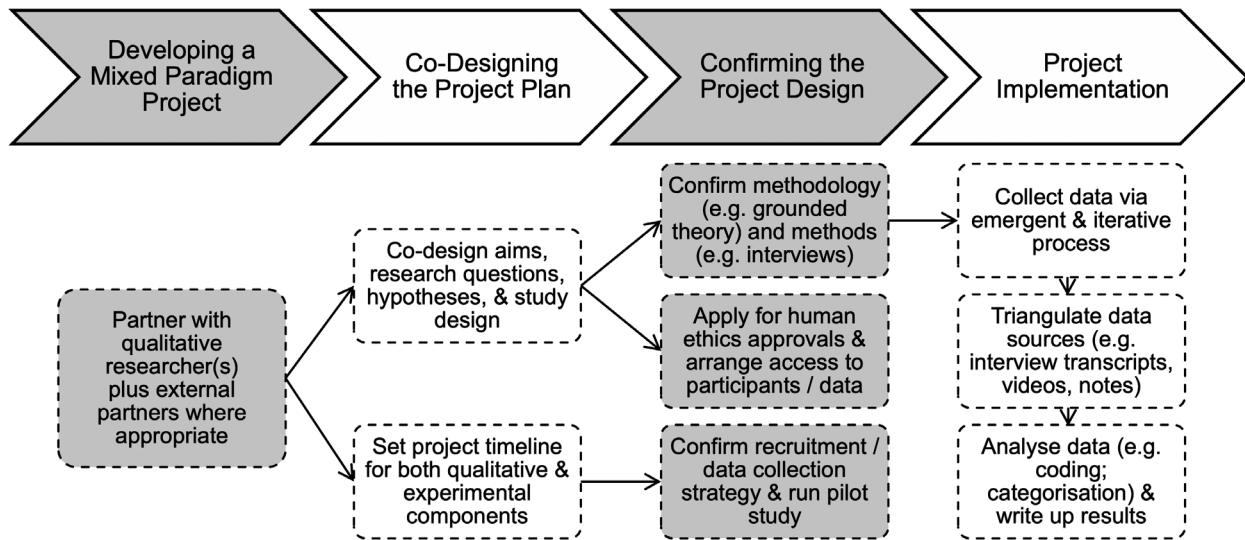


Fig. 2. Key steps in conducting the qualitative component of a mixed paradigm research project.

Build strong and ongoing partnerships with qualitative researchers working in relevant disciplines such as sociology, education and information science:

- Partner with qualitative researcher(s) to develop a co-authored paper, as a starting point for developing interdisciplinary research project ideas;
- Co-supervise in other disciplines where students are studying topics related to ecology;
- Co-edit a special issue of a journal on interdisciplinary topics including qualitative approaches.

When developing a mixed paradigm project, the first step is to partner with a qualitative researcher (see Fig. 2). The process will involve the co-design of a relevant research problem and research questions that will inform the qualitative design, to be conducted in parallel to the experimental design components; this may also involve external, non-academic partners where appropriate. There are many decision points involved in this process, ranging from the choice of methodology (e.g. grounded theory, hermeneutics, discourse analysis) and methods (e.g. interviews, focus groups, photovoice, content analysis), preparation of ethics applications and strategies for collecting and analysing data from various sources. Qualitative analysis techniques are highly specialized and require years of preparation and experience, so partnerships with methodological experts must be ongoing throughout the study's implementation and in publishing results. Figure 3 represents a worked example to address the research problem: 'How do people value ecological diversity in their neighbourhoods?' In this example, three specific research questions have identified that drive the selection of a methodology that will best ascertain

people's perceptions and understandings of the phenomena to be studied. The figure outlines some of the key decision points and activities that the project design team makes at various stages of research design, from initial concepts through to the writing and publication phase.

While qualitative research methods offer powerful means to explain why things happen in social-ecological systems, they have often been misused, ignored, or dismissed by factions within the ecological science community. Qualitative designs are becoming more and more salient to the types of questions the discipline is asking – most notably, 'How do we operationalize our knowledge of social-ecological links into actions that promote biodiversity conservation in urban areas and beyond?' (Knapp *et al.* 2021, p. 271). Engaging with qualitative researchers offers enormous potential to understand the human dimensions of ecology, and ultimately improves the quality of conservation actions and outcomes.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

Ryan J Keith: Conceptualization (equal); writing – original draft (lead); writing – review and editing (equal). **Lisa M Given:** Conceptualization (equal); writing – original draft (supporting); writing – review and editing (equal). **John Martin:** Conceptualization (equal); writing – original draft (supporting); writing

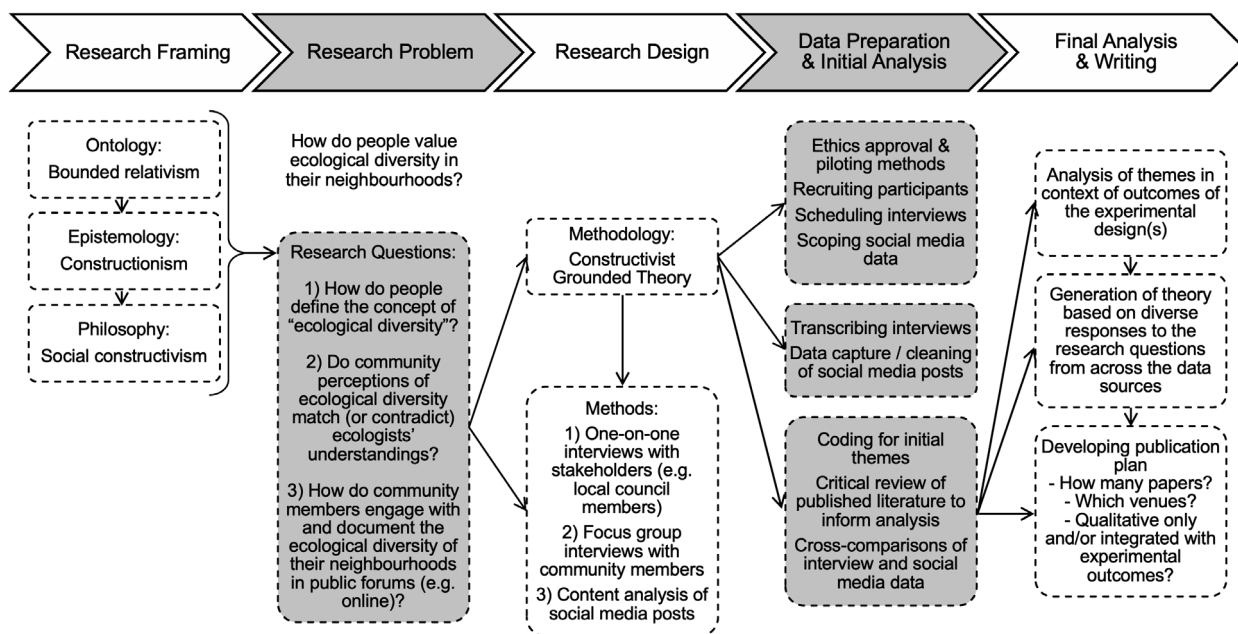


Fig. 3. Example of the qualitative component within a mixed paradigm project focused on neighbourhood biodiversity.

– review and editing (equal). **Dieter F Hochuli:** Conceptualization (equal); writing – original draft (supporting); writing – review and editing (equal).

REFERENCES

- Adams W. M. (2007) Thinking like a human: Social science and the two cultures problem. *Oryx* **41**, 275–6.
- Alise M. A. & Teddlie C. (2010) A continuation of the paradigm wars? Prevalence rates of methodological approaches across the social/behavioral sciences. *J. Mixed Methods Res.* **4**, 103–26.
- Andrade K., Corbin C., Diver S. *et al.* (2014) Finding your way in the interdisciplinary forest: Notes on educating future conservation practitioners. *Biodivers. Conserv.* **23**, 3405–23.
- Aplin L. M., Major R. E., Davis A. & Martin J. M. (2021) A citizen science approach reveals long-term social network structure in an urban parrot, *Cacatua galerita*. *J. Anim. Ecol.* **90**, 222–32.
- Arnold A., Cafer A., Green J., Haines S., Mann G. & Rosenthal M. (2021) Perspective: Promoting and fostering multidisciplinary research in universities. *Res. Policy* **50**, 104334.
- Ashayeri S. & Newing H. (2012) Meat, markets, pleasure and revenge: Multiple motivations for hunting in Bamou National Park, Fars Province, Iran. *Parks* **18**, 125–33.
- Başkarada S. & Koronios A. (2018) A philosophical discussion of qualitative, quantitative, and mixed methods research in social science. *Qual. Res. J.* **18**, 2–21.
- Batterbury S. P. J. & Toscano M. (2018) Seeking justice through interdisciplinary environmental education at postgraduate level: Lessons from Melbourne, Australia. *Int. J. Educ. Soc. Just.* **7**, 141–56.
- Bennett N. J., Roth R., Klain S. C. *et al.* (2017a) Conservation social science: Understanding and integrating human dimensions to improve conservation. *Biol. Conserv.* **205**, 93–108.
- Bennett N. J., Roth R., Klain S. C. *et al.* (2017b) Mainstreaming the social sciences in conservation. *Conserv. Biol.* **31**, 56–66.
- Biggs D., Cooney R., Roe D. *et al.* (2017) Developing a theory of change for a community-based response to illegal wildlife trade. *Conserv. Biol.* **31**, 5–12.
- Bonney R., Cooper C. B., Dickinson J. *et al.* (2009) Citizen science: A developing tool for expanding science knowledge and scientific literacy. *Bioscience* **59**, 977–84.
- Brister E. (2016) Disciplinary capture and epistemological obstacles to interdisciplinary research: Lessons from central African conservation disputes. *Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences* **56**, 82–91.
- Burr V. (2015) *Social Constructionism*. Routledge, New York, NY.
- Ceballos G., Ehrlich P. R., Barnosky A. D., García A., Pringle R. M. & Palmer T. M. (2015) Accelerated modern human-induced species losses: Entering the sixth mass extinction. *Science. Advances* **1**, e1400253.
- Collins C. S. & Stockton C. M. (2018) The central role of theory in qualitative research. *Int. J. Qual. Meth.* **17**, 1–10.
- Colloff M. J., Lavorel S., van Kerkhoff L. E. *et al.* (2017) Transforming conservation science and practice for a post-normal world. *Conserv. Biol.* **31**, 1008–17.
- Crotty M. (1998) *The Foundations of Social Research: Meaning and Perspective in the Research Process*. Sage, London.
- Davis A., Taylor C. E. & Martin J. M. (2019) Are pro-ecological values enough? Determining the drivers and extent of participation in citizen science programs. *Hum. Dimens. Wildl.* **24**, 501–14.
- Denzin N. K. & Lincoln Y. S. (2011) The discipline and practice of qualitative research. In: *The SAGE Handbook of Qualitative Research* (eds N. K. Denzin & Y. S. Lincoln) pp. 1–19. Sage, Thousand Oaks, CA.

- Drury R., Homewood K. & Randall S. (2011) Less is more: The potential of qualitative approaches in conservation research. *Anim. Conserv.* **14**, 18–24.
- Eigenbrode S. D., O'Rourke M., Wulffhorst J. D. *et al.* (2007) Employing philosophical dialogue in collaborative science. *Bioscience* **57**, 55–64.
- Evely A. C., Fazey I., Pinard M. & Lambin X. (2008) The influence of philosophical perspectives in integrative research: A conservation case study in the Cairngorms National Park. *Ecol. Soc.* **13**, 52–67.
- Fetters M. D. & Molina-Azorin J. F. (2017) The journal of mixed methods research starts a new decade: The mixed methods research integration trilogy and its dimensions. *J. Mixed Methods Res.* **11**, 291–307.
- Francis K., Henderson M., Martin E., Saul K. & Joshi S. (2018) Collaborative teaching and interdisciplinary learning in graduate environmental studies. *J. Environ. Stud. Sci.* **8**, 343–50.
- Ghoddousi A., Soofi M., Hamidi A. K. *et al.* (2017) The decline of ungulate populations in Iranian protected areas calls for urgent action against poaching. *Oryx* **53**, 151–8.
- Given L. M. (2008) *The SAGE Encyclopedia of Qualitative Research Methods*. Sage, Thousand Oaks, CA.
- Given L. M. (2016) *100 Questions (and Answers) about Qualitative Research*. Sage, Thousand Oaks, CA.
- Given L. M. (2017) It's a new year... so let's stop the paradigm wars. *Int J Qual Methods* **16**, 1–2.
- Hall M. J., Burns A. L., Martin J. M. & Hochuli D. F. (2021) Ecological insights into a charismatic bird using different citizen science approaches. *Aus. Ecol.*, In press.
- Harrison S., Massey D. & Richards K. (2008) Conversations across the divide. *Geoforum* **39**, 549–51.
- Hesse-Biber S. N. (2010) *Mixed Methods Research: Merging Theory with Practice*. Guildford Press, New York, NY.
- Jacob W. J. (2015) Interdisciplinary trends in higher education. *Palgrave Comm.* **1**, 1–5.
- Johnson R. B., Onwuegbuzie A. J. & Turner L. A. (2007) Toward a definition of mixed methods research. *J. Mixed Methods Res.* **1**, 112–33.
- Kelley P. H., Dietl G. P. & Visaggi C. C. (2019) Model for improved undergraduate training in translational conservation science. *Conserv. Sci. Pract.* **1**, e5.
- Knapp S., Aronson M. F. J., Carpenter E. *et al.* (2021) A research agenda for urban biodiversity in the global extinction crisis. *Bioscience* **71**, 268–79.
- Leavy P., ed (2020) *The Oxford Handbook of Qualitative Research*, 2nd edn. Oxford University Press, Oxford, UK.
- Lester J., Goodman N. & O'Reilly M. (2021) Introduction to special issue: Diverse approaches to qualitative data analysis for applied research. *Qual. Rep.* **26**, 1989–95.
- Lukyanenko R., Parsons J. & Wiersma Y. F. (2016) Emerging problems of data quality in citizen science. *Conserv. Biol.* **30**, 447–9.
- Miller J. R. (2005) Biodiversity conservation and the extinction of experience. *Trends Ecol. Evol.* **20**, 430–4.
- Moon K. & Blackman D. A. (2014) A guide to understanding social science research for natural scientists. *Conserv. Biol.* **28**, 1167–77.
- Moon K., Brewer T. D., Januchowski-Hartley S. R., Adams V. M. & Blackman D. A. (2016) A guideline to improve qualitative social science publishing in ecology and conservation journals. *Ecol. Soc.* **21**, 17.
- Newing H. (2010) *Conducting Research in Conservation: A Social Science Perspective*. Routledge, London.
- O'Rourke M. & Crowley S. J. (2013) Philosophical intervention and cross-disciplinary science: The story of the toolbox project. *Synthese* **190**, 1937–54.
- Popa F. & Guillermin M. (2017) Reflexive methodological pluralism: The case of environmental valuation. *J. Mixed Methods Res.* **11**, 19–35.
- Price L. (2016) Key critical realist concepts for environmental educators. In: *Critical Realism, Environmental Learning and Social-Ecological Change* (eds L. Price & H. Lotz-Sistka) pp. 18–39. Routledge, New York, NY.
- Rust N. A., Abrams A., Challender D. W. S. *et al.* (2017) Quantity does not always mean quality: The importance of qualitative social science in conservation research. *Soc. Nat. Resour.* **30**, 1304–10.
- Sandbrook C., Adams W. M., Büscher B. & Vira B. (2013) Social research and biodiversity conservation. *Conserv. Biol.* **27**, 1487–90.
- Sandbrook C., Scales I. R., Vira B. & Adams W. M. (2011) Value plurality among conservation professionals. *Conserv. Biol.* **25**, 285–94.
- Schuitema G. & Sintov N. D. (2017) Should we quit our jobs? Challenges, barriers and recommendations for interdisciplinary energy research. *Energy Policy* **101**, 246–50.
- Schultz P. W. (2011) Conservation means behavior. *Conserv. Biol.* **25**, 1080–3.
- Silvertown J. (2009) A new dawn for citizen science. *Trends Ecol. Evol.* **24**, 467–71.
- Soulé M. E. (1985) What is conservation biology? *Bioscience* **35**, 727–34.
- St. John F. A. V., Keane A. M., Jones J. P. G. & Milner-Gulland E. J. (2014) Robust study design is as important on the social as it is on the ecological side of applied ecological research. *J. Appl. Ecol.* **51**, 1479–85.
- Strang V. (2009) Integrating the social and natural sciences in environmental research: A discussion paper. *Environ. Dev. Sustain.* **11**, 1–18.
- Sutherland W. J., Dicks L. V., Everard M. & Geneletti D. (2018) Qualitative methods for ecologists and conservation scientists. *Methods Ecol. Evol.* **9**, 7–9.
- Swim J. K., Clayton S. & Howard G. S. (2011) Human behavioral contributions to climate change: Psychological and contextual drivers. *Am. Psychol.* **66**, 251–64.
- Taylor B., Chapron G., Kopnina H., Orlikowska E., Gray J. & Piccolo J. J. (2020) The need for ecocentrism in biodiversity conservation. *Conserv. Biol.* **34**, 1089–96.
- Teel T. L., Anderson C. B., Burgman M. A. *et al.* (2018) Publishing social science research in conservation biology to move beyond biology. *Conserv. Biol.* **32**, 6–8.
- Underwood A. J. (1997) *Experiments in Ecology: Their Logical Design and Interpretation Using Analysis of Variance*. Cambridge University Press, Cambridge.
- Vadrot A. B. M., Rankovic A., Lapeyre R., Aubert P.-M. & Laurans Y. (2018) Why are social sciences and humanities needed in the works of IPBES? A systematic review of the literature. *Innovation: The European Journal of Social Science Research* **31**, S78–S100.
- Westgate M. J., Barton P. S., Lindenmayer D. B. & Andrew N. R. (2020) Quantifying shifts in topic popularity over 44 years of austral ecology. *Austral Ecol.* **45**, 663–71.
- Williams S. J. & Gordon H. L. (2015) Paradigms and progress in conservation science. *Conserv. Biol.* **29**, 3–4.
- Young J. C., Rose D. C., Mumby H. S. *et al.* (2018) A methodological guide to using and reporting on interviews in conservation science research. *Methods Ecol. Evol.* **9**, 10–9.