Place, case and process: applying ecology to sustainable development

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Abstract

We outline a pragmatic approach through which ecologists, by participating in interdisciplinary research, can engage with sustainable development. The approach is based on three points of intersection that facilitate the integration of ecological insights with insights from other disciplines and stakeholders. The first point of intersection, *place*, emphasizes the value of carefully choosing where to conduct an interdisciplinary research project. We argue that, from a sustainability perspective, research will be of most applied value if it takes place in locations that actually face urgent sustainability problems (including biodiversity decline). The second point of intersection, *case*, suggests that integration among different disciplines can be facilitated by choosing common study cases or units of analysis. For example, ecologists and scientists from other disciplines can focus on the same farms, villages or landscapes in their work. Sharing cases helps to create comparable data for integration, but also facilitates communication across disciplinary boundaries because it creates shared experiences in the field. The third point of intersection, *process*, relates to operational features of team research that improve integration across disciplines and communication with stakeholders. Key process-related features are working in a small, co-located team, planning for independent as well as joint project activities, involving some key stakeholders early on in the research process, and carefully targeting communication at different relevant audiences. In combination, an approach centred around place, case and process provides a tangible and pragmatic way for ecologists to meaningfully engage with real-world sustainability problems.

Zusammenfassung

Wir schildern einen pragmatischen Ansatz, mit dem Ökologen mittels interdisziplinärer Forschungsprojekte zur nachhaltigen Entwicklung beitragen können. Unser Ansatz basiert auf drei Aspekten, die die Integration ökologischer Erkenntnisse mit den Erkenntnissen anderer Disziplinen und Stakeholdern ermöglichen. Der erste Aspekt—„*Place*“ oder „*Ort*“—bezieht sich auf die sorgfältige Auswahl des Ortes, an dem interdisziplinäre Forschung stattfinden soll. Forschung wird den größten angewandten Nutzen für die Nachhaltigkeit haben, wenn an einem solchen Ort tatsächlich akute Nachhaltigkeitsprobleme bestehen (inkl. Verlust von Biodiversität). Der zweite Aspekt—„*Case*“ oder „*Fall*“—bedeutet, dass den Analysen die gleichen Fälle zu Grunde liegen sollten und somit die Integration verschiedener disziplinärer Sichtweise vereinfacht wird. So können Ökologen und Wissenschaftler anderer Disziplinen beispielsweise die gleichen Bauernhöfe, Dörfer oder Landschaften zu ihrem Forschungsgegenstand machen. Die Arbeit an gemeinsamen Fällen trägt dazu bei, vergleichbare Daten zu generieren und die Kommunikation über disziplinäre Grenzen hinweg zu erleichtern; nicht zuletzt, weil es so bei der Feldarbeit zu gemeinsamen Erfahrungen kommen kann. Der dritte Aspekt—„*Process*“ oder „*Prozess*“—beschreibt, wie Abläufe im Forschungsprozess die Integration zwischen Disziplinen und die Kommunikation mit Stakeholdern fördern können. Besonders wichtig sind hierbei die Nutzung gemeinsamer Räumlichkeiten, die Planung gemeinsamer aber auch unabhängiger Forschungsaktivitäten, das frühe Einbinden wichtiger Stakeholder in den Forschungsprozess, und gezielte Kommunikation der Forschungsergebnisse an unterschiedliche Zielgruppen. Der hier beschriebene Ansatz um die drei Schnittstellen *Place*, *Case* und *Process* zeigt einen konkreten und pragmatischen Weg auf, wie Ökologen mit ihre Expertise zur Lösung realer Nachhaltigkeitsprobleme beitragen können.

Keywords: coupled human and natural systems, human-environment systems, interdisciplinarity, social-ecological systems, sustainable development, sustainability science, transdisciplinarity

Introduction

Ecology is the science of understanding the interactions of life with its environment. At no time in history has ecology been more important from a practical perspective: we are on the verge of the sixth mass extinction event (Barnosky, Matzke, Tomiya, Wogan, Swartz et al. 2011; Pereira, Leadley, Proenca, Alkemade, Scharlemann et al. 2010), but the first one caused by a biological species – namely, *Homo sapiens*. Many young scholars are now attracted to ecology not only because they are interested in how the world works. Rather, they hope that ecological expertise might help maintain and foster life on Earth. To such scholars, science provides an important knowledge base, but their ultimate goal is the practical application of this knowledge. Many labels exist for those interested in pursuing ecology for the sake of a goal broader than the pursuit of knowledge *per se*. They call themselves conservation biologists, restoration ecologists or sustainability scientists; or sometimes simply applied ecologists or landscape ecologists.

The desire to apply ecology to real-world problems is not always easy to satisfy in a modern academic context. Reward structures in academia are largely indifferent to real-world contributions, often encourage specialisation and empire-building to the detriment of the integration of knowledge, and inadvertently might even erode collegiality and creativity (Colquhoun 2007; Fischer, Ritchie & Hanspach 2012; Kaushal & Jeschke 2013; Sherren 2009). One specific challenge related to interdisciplinary collaboration relates to the substantial time commitment required by contributing individuals. Shared problem framing can be difficult and requires frequent and sometimes time-consuming exchange among collaborators. Similarly, the preparation of research papers can take longer than in the case of traditional, disciplinary papers (Campbell 2005). Moreover, existing reward systems increasingly focus on "big data", rather than a deep understanding of local ecological issues (Lindenmayer & Likens 2011), and funding can be particularly difficult to obtain for interdisciplinary work (Campbell 2005).

This paper is based on the premise that many ecologists (especially "next generation" ecologists) are interested in applying their scientific understanding to effect real-world outcomes, but lack a clear vision, or systematic approach, for how to do so within existing institutional structures. Here, we

outline our own approach for how to apply ecology to the world in the context of interdisciplinary team research. We believe it is vital that ecology is integrated with other disciplines (especially social sciences such as sociology, economics and public policy) to meaningfully contribute to solving real-world problems – of which we have no shortage in the 21st century. To solve real-world problems, the insights of ecologists are necessary but, by themselves, insufficient. Ecology could help, for example, to identify desirable management options in a particular setting (such as an agricultural landscape). But "rational evidence" on its own will not be enough to cause the widespread uptake of more desirable management options (Adams & Sandbrook 2013). In such a context, important complementary insights are needed on the values and needs of local stakeholders, as well as on existing governance structures and how these could be altered.

We make no claims that the approach to interdisciplinary team research we outline here is necessarily superior to other approaches. We simply argue that it is one pragmatic way in which ecologists can engage meaningfully with real-world problems. The approach we describe is structured around three simple points of intersection, namely *place*, *case* and *process* (Sherren, Fischer, Clayton, Schirmer & Dovers 2010). Drawing on projects from Southeastern Australia and Central Romania, we discuss how each of these three points of intersection has helped us to develop interdisciplinary research agendas drawing (among others) on ecology, but aiming to contribute to real-world outcomes.

Place

Both in Australia and Romania, we first considered where research was actually needed. This might seem like an obvious step, but it differs substantially from many projects that are driven primarily by a desire for "neat science". In other words, our research agendas in both projects were not primarily shaped by a desire to test a particular hypothesis or theory. Rather, both projects aimed to use science to understand a real-world problem and identify possible solutions for it. This approach is consistent with the developing discipline of "sustainability science", which is problem-driven and solution-oriented (Clark 2007; Kates, Clark, Corell, Hall, Jaeger et al. 2001). It is also consistent with the

111 Programme on Ecosystem Change and Society (PECS; funded by the International Council for
112 Science, ICSU; http://pecs-science.org/), which recognises the need for comparative place-based
113 research in social-ecological systems (Carpenter, Folke, Norstrom, Olsson, Schultz et al. 2012).

114 The identification of a "problem worth solving" may be based on the understanding of experts (e.g.
115 ecologists or researchers from other disciplines), or on the understanding of other stakeholders (e.g.
116 citizens, companies, civil society organisations, or government agencies). Clearly, a genuine, local
117 problem that is of interest to a wide range of stakeholders ensures a ready supply of interested agencies
118 and citizens with whom to engage. This, in turn, is likely to improve the quality of the research, as
119 well as its chances to have real-world impact. Yet, we believe there is also value in addressing an issue
120 identified as important by a small number of experts, but which is not yet on the radar of other
121 stakeholders. For example, Rachel Carson was famously (and rightly) concerned about the
122 biologically disastrous effects of the pesticide dichlordiphenyltrichlorethan (DDT) well before the vast
123 majority of stakeholders who applied this pesticide (Carson 1962).

124 Why did we believe the two places we chose were worth studying? Our study system in Australia was
125 a farming area that was dominated by *Eucalyptus* woodlands prior to European settlement in the
126 1800s. The system is now greatly simplified, and tree cover in many locations is 15% or less. What is
127 even more concerning from an ecological perspective, many of the remnant trees are not regenerating,
128 and tree-dependent biodiversity is rapidly being lost. The problem of tree regeneration failure had been
129 highlighted by perceptive ecologists several decades ago (Saunders 1979). However, the issue had
130 never been addressed systematically across entire landscapes, and was routinely glossed over in public
131 and policy discourses. Some stakeholders in our study area were clearly gravely concerned, as
132 indicated by several farmers taking the initiative to plant trees across their properties or change grazing
133 practices to mitigate tree decline. Hence, it was both our "expert" understanding, as well as concerns
134 by local people, which led us to examine the issue of regional-scale tree regeneration failure. Our
135 overarching goal was to apply science to better understand the problem of tree regeneration failure
136 over a large area (our study area measured just under 1 million hectares). "Science" in this context was
137 not limited to ecology. While the ecological issues associated with tree regeneration were of core

interest to our project, we also studied stakeholder values, and the economic and policy context in which farmers operated. We also tried to involve regional stakeholders, such as policymakers, farmers, and non-government organisations. To this end, we used a wide range of mechanisms, including workshops that helped to refine our research questions early on, so they were locally relevant (Sherren, Dovers, Fischer & Schirmer 2009), research techniques that elicited the values and needs of local people (Sherren, Fischer & Price 2010), and readily accessible communication materials such as video animations (Sherren, Fischer, Clayton, Hauldren & Dovers 2011). The bulk of the work on this project was conducted between 2007 and 2010.

The study in Romania commenced in late 2010 and is ongoing. Here, too, our research is guided by a belief that this is a "place" particularly worthy of scientific attention. Like in the study in Australia, there are obvious ecological problems (and other sustainability problems) that need to be addressed. Yet, the knowledge base for how to address these problems is patchy, and awareness of the problems among policy makers and the general public is often low. Our study area in Romania is one of the last strongholds of farmland biodiversity in Europe – we regularly come across species that are rare in much of the rest of Europe, including birds such as the corncrake (*Crex crex*), several butterfly species (e.g. *Lycaena dispar*, *Phengaris arion*, *Euphydrias aurinia*), and the European brown bear (*Ursus arctos*). The tremendous ecological value of the study area is, however, under threat from a complex set of social drivers, including aspirations for greater economic prosperity, demographic and ethnic changes, and political problems such as corruption (Mikulcak, Newig, Milcu, Hartel & Fischer 2013). Like in Australia, our research in Romania focuses on better understanding the ecology of the area, but we also aim to understand the policy environment and the hopes, values and preferences of local people. Again, we involve stakeholders in our research where possible, as research subjects as well as collaborators, eliciting their values, knowledge and feedback through interviews, workshops and other communication channels as appropriate.

In summary, we argue that a useful first step in putting ecology to work for sustainability is to think carefully about where research is needed most urgently. Valid and tangible sustainability problems, in turn, may be identified by researchers or by local stakeholders. Of course, it is possible to conduct

excellent ecological research in systems not facing immediate threats of any kind. Yet, we argue that systems actually facing acute development pressures offer particularly interesting (albeit challenging) opportunities to apply ecology to real-world problems.

Case

An important feature of our approach is that ecological work is embedded within a broader, interdisciplinary framework. Interdisciplinary work requires scholars with different backgrounds to identify meaningful points of intersection where different disciplinary insights can meet and merge into a holistic, interdisciplinary understanding. We found that a useful way to facilitate such intersections is by ecologists and social scientists focusing on the same "cases" within the study area (i.e. place). We define cases as replicated social-ecological units that can be studied in meaningful ways from different disciplinary perspectives. What constitutes a useful social-ecological unit will differ between places. For example, in Quebec, Raudsepp-Hearne et al. (2010) focused on municipalities because within the context of their work (on ecosystem services) these were both socially and ecologically relevant areas.

In Australia, we focused on individual farms as replicated cases, or social-ecological units. We worked on approximately 30 farms that represented a gradient in approaches to livestock grazing – a key variable in the context of tree regeneration. Farms were meaningful social-ecological units because they were relatively large and therefore meaningful ecologically (typical farms measured just under 1000 ha), and because farm management strategies differed strongly from one farm to the other. The aspirations and economic realities of the individual farmers using different grazing approaches (variables of interest to social scientists) therefore could be expected to directly influence the ecological values of a particular farm.

In Romania, individual farms would be less useful as cases. Many local farmers are semi-subsistence farmers, who hold tiny parcels of land in different parts around a given village. Moreover, livestock grazing typically occurs on communal pastures, both for sheep and cows. Whole villages, by contrast,

191 are more meaningful social-ecological cases. Like Australian farms, different villages are governed
192 very differently (e.g. because of different mayors or groups of people that are active locally), and
193 ecological outcomes can vary substantially from one village to another. Moreover, villages differ in
194 their biophysical nature (e.g. terrain ruggedness), ethnic composition (e.g. Hungarian versus
195 Romanian) and legal protection status (some land is within the EU Natura 2000 network, some is not).
196 Like in Australia, we chose approximately 30 villages as replicated cases on which both ecologists and
197 social scientists can focus their activities.

198 Identifying shared "cases" has been tremendously helpful to facilitate communication across
199 disciplines in both study areas. Conversations among scholars working on the same cases naturally
200 evolve from logistic questions ("I had trouble finding the road to farm x – did you, too?") to those at
201 the heart of sustainable development ("Amazing how they still mow the meadows by hand – is that
202 what they want to do though?"). Having shared cases for different disciplines (within a shared place)
203 is a pragmatic, but extremely powerful tool to break down disciplinary barriers, and provides valuable
204 social and ecological data on the same study units.

205

206 **Process**

207 Finally, making ecology relevant to real-world problems is helped greatly by putting in place various
208 processes of integration – both among disciplines, and between science and society. Integration among
209 disciplines, as discussed above, is greatly helped by different scholars focusing on the same place, and
210 sharing concrete cases. Equally important, however, is the recognition that integrated research
211 probably works best in small teams, ideally co-located and with the integrative project comprising a
212 large share of the participants' workloads. In very large teams, it is likely that sub-groups emerge that
213 do not regularly exchange ideas, and these may well align along disciplinary boundaries. In small
214 research teams, by contrast, people regularly see each other and get to know one another. The personal
215 trust thus built is tremendously useful in facilitating communication among people as colleagues and
216 maybe even friends: disciplinary boundaries become largely irrelevant in such a context.

Moreover, we found that it is useful to develop a strategic mix of independent and joint activities within the research team. It is important to plan (and reflect on) what can be done jointly with the whole project team. But interdisciplinarity also depends on the disciplinary depth that it can draw on. Hence, it is equally important that individual team members carry out their disciplinary research autonomously, be it in ecology or the social sciences. The benefits are two-fold. First, disciplinary peer review and publication in the field ensures that interdisciplinarity does not diminish career prospects (Sherren 2009). Second, it streamlines the work, as not every step must involve everyone's input, so long as time is made for regular, in-depth discussions across all elements.

In addition to integration across disciplines, integration with stakeholders is vital for ecology (or any other discipline) to have societal impact. While there are relatively straightforward, pragmatic ways to integrate different disciplines, at this point, we do not believe that any such "recipes" exist to integrate academic insights with insights by other stakeholders. Much has been written about "transdisciplinary research", that is, approaches to bridge gaps between researchers and society (Brandt, Ernst, Gralla, Luederitz, Lang et al. 2013; Brown, Harris & Russell 2010). Based on our personal experience, we believe it is likely that every project will need to individually tailor its own specific approach for stakeholder engagement. Such an approach needs to be based on a strong understanding of local conditions, including cultural norms and power relationships. Sometimes it will make sense to engage stakeholders very deeply, and sometimes it will make sense to engage them less deeply. Three pieces of experience may be worth highlighting. First, we found it useful to engage with some "trusted" stakeholders early on (even when framing some of the questions) because this usually facilitates much faster learning about a place (especially if it faces complex challenges). In Australia, we spoke to selected farmers before even writing our initial funding application. Similarly, in Romania, we entered dialogues with local non-government organisations before preparing our initial project plan. Furthermore, in Australia, we held an early scoping workshop with stakeholders to ascertain their views. We then made the results of this workshop publicly available (Sherren et al. 2009), to invite comment and allow for additional research to be sparked in areas that we were unable to cover within our project.

Second, it is important to work with stakeholders regularly throughout a project. In parallel to experiences within the research team, through time, barriers between practitioners and scientists break down as people get to know and trust one another. The more stakeholders feel a sense of "joint ownership" of the research, the more likely the research findings are to influence them in some way further down the line. A few participating Australian graziers became innovators in ways to implement our recommendations, and we reflected in turn on their ideas in later phases of the project. Stakeholders were also able to help us interpret, and identify weaknesses in our results.

In Romania, we made a decision early on to closely collaborate with several Romanian researchers, as well as a local non-government organisation. However, in comparison with Australia, we are probably less successful with our attempts to engage stakeholders in Romania. Two key reasons for this are (i) unlike in Australia, we are not permanently embedded within the study area in Romania; and (ii) owing to its communist history, Romania is notorious for relatively high levels of mistrust within the community and relatively low levels of civic engagement.

Third, it can be useful to develop a communication portfolio that is targeted at different stakeholders. For example, in Australia we supported the development of learning materials for elementary and high schools, and extension materials for farmers, but also presented our findings to government officials. Quite obviously, different strategies are required for these different audiences. In Romania, not all members of the project team speak the local languages, and therefore we carry flyers with us that explain what we do in language that is accessible to locals. We are also in the process of writing a bilingual booklet that is targeted at NGOs and other local leaders. Notably, not all stakeholders are equally important in all contexts, and it pays (in terms of time invested) to prioritise whether, when and how to target various groups of people.

What about outcomes?

Our reflection around the notions of place, case and process may seem like a simple recipe for sustainability science (and some may find it simplistic). While we do believe that our approach is

useful and pragmatic, we make no claims that there is any guarantee that conducting a research project using this approach will in fact result in any measurable outcomes in the real world. Yet, we argue that our approach at least has a good chance of facilitating improved interdisciplinary and transdisciplinary science – in which ecology can play a key role. Will tree regeneration in Australia improve as a result of our work? Will Central Romania embrace sustainable development? In both cases, we hope that our work does make some kind of difference – for example, by changing the way stakeholders think about the problem, or by empowering certain individuals or organisations to take action. But it should be obvious that it is simply demanding too much of a single research project to fundamentally change the trajectories on which certain social-ecological systems have embarked. But to our minds, it would be false to conclude that therefore there is no point in trying. It may just mean that more researchers are needed who work in similar ways.

Key obstacles to sustainable development in both Australia and Romania result from fundamental global problems, including an economic system that rewards conventional, intensive farming. One way to conceptualize the challenge of sustainable development is to consider it as a hierarchy of change processes. While specific management actions can, in principle, be altered relatively easily, societal norms and structures are more difficult to change; community attitudes towards issues of equity, sustainability and the environment are yet more difficult to change; and hardest of all is to fundamentally alter societal value and belief systems that have evolved over a long time (Fischer, Dyball, Fazey, Gross, Dovers et al. 2012). In our view, good sustainability science needs to address all of these levels, from pragmatic to fundamental – but not every project should be expected to effect change at all levels.

From theory to practice

Integration by place, case and process requires, first of all, a vision for where such research is needed. Thanks to the massive losses of biodiversity we witness around the world, it should be easy for ecologists to think of examples where this kind of approach could be useful. An important source of

296 inspiration for own research, of course, has been the previous work of other people. Journals that
297 regularly publish place-based research about the interaction of humans with their environment are, for
298 example, *Ecology & Society*, *Ambio*, *Society & Natural Resources*, *Landscape & Urban Planning*,
299 *Landscape Ecology*, and *Regional Environmental Change*. Moreover, there are several international
300 initiatives (e.g. PECS; *Satoyama Initiative*, http://satoyama-initiative.org/en/), meetings (e.g. by the
301 Resilience Alliance; http://www.resalliance.org/) and training opportunities (e.g. the Alternet summer
302 school; http://www.alter-net.info/) that are worth investigating for those interested in further pursuing
303 this direction.

304 Once there is a vision, funding needs to be raised. While some have argued that obtaining funding for
305 interdisciplinary work is inherently more difficult (Campbell 2005), this need not necessarily be the
306 case. However, it may require a little more imagination – especially in countries that have traditionally
307 separated the natural and social sciences into different granting agencies (e.g. Canada). In Australia,
308 our first project was funded by two separate government programmes. The first programme (the
309 Australian Research Council) funded only the ecological component of the work. Immediately after
310 this component was funded, we sought funding for the social science components (through the
311 Commonwealth Environment Research Facility), noting in our funding application that we had a
312 unique opportunity to build on the existing project. In Romania, we were more fortunate, with the vast
313 majority of the project being funded through one grant (by the Alexander von Humboldt Foundation).

314 When it comes to assembling the research team, our experience suggests that serendipity around issues
315 such as who-knows-who and who-has-time is important. Equally important, however, is to find people
316 who share the overall vision and get along on a personal level. Perhaps surprisingly, the precise
317 academic profiles of the individuals making up a research team may be less important than their ability
318 to work together with a common vision, and see each other often.

319 Finally, local stakeholders are vital as research partners, and it pays to involve some key stakeholders
320 from the outset. Different stakeholders will be suitable in different study areas – they may include
321 active farmers, community leaders, local politicians, or non-government organisations.

To conclude, the three simple notions of place, case and process offer a pragmatic way forward for those who seek to apply their ecological expertise to real-world sustainability problems. We re-iterate that the approach we suggested here is just one of many ways to make ecology relevant to sustainability. Whatever we choose to do, we should do so with a sense of urgency: what, if not the sixth mass extinction event, does it take for us to try new ways to make our ecological expertise matter?

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