

# Advice for interdisciplinary biodiversity research

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## Abstract

The need for interdisciplinarity to address global challenges has been expressed for decades, but the development of effective interdisciplinary work is slow. The tardiness might be related to the scarcity of literature on what interdisciplinarity means in practice that could guide new collaborations. This perspective presents a guide for interdisciplinary work in biodiversity research in practice. The focus is set on bridging between scholars from biology and from social science and humanities. The structure follows three overarching and interlinked dimensions of importance for interdisciplinary work: People, Process and Perspectives. People is about both the team composition and the characteristics of individual researchers. Process concerns how the work is planned and the organizing structure. Perspectives include approaches, concepts, and frameworks. Since the character of projects varies, there can be no detailed blueprint for interdisciplinary biodiversity research, but dialog and mutual respect are clearly key.

## KEYWORDS

guidance for interdisciplinary work, interdisciplinary collaboration, research practice

## 1 | INTRODUCTION

The need for interdisciplinary approaches to address contemporary global challenges has been expressed for decades (Ledford, 2015; Mascia et al., 2003; Nature Editorial, 2022). As calls for interdisciplinarity echo in similar ways over the years, it has to be questioned why the development of effective interdisciplinary work is so slow (cf. Craven et al., 2019). Similar to other environmental challenges, biodiversity loss has traditionally been reckoned as a natural science field of study, and there is still a heavy dominance of biologists in the field as well as a biological bias in how the issue is framed and approached (Bennett et al., 2016). The difficulties

experienced by The Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) in attracting scholars from the social sciences and humanities (SSH) are an indication of this bias (Masood, 2018; Stokland et al., 2022). This bias has negative consequences for the accuracy of advice provided to conservation policy and practices and a significant risk for ineffective or even counterproductive conservation policies and measures, due to insufficient recognition and inclusion of scientifically credible knowledge on crucial issues such as human behavior, governance, conflict-laden issues (Löfmarck & Lidskog, 2017).

There is no shortage of papers calling for more interdisciplinary work on conservation interventions and

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elaborating on how that would improve both the scientific quality and the societal relevance of conservation research (see, e.g., Martin, 2020; Vadrot et al., 2018). There is also an increasing number of publications theorizing on interdisciplinarity work as, for example, overarching approaches and categories of knowledge co-production (e.g., Preiser et al., 2021; Schlüter et al., 2022; West et al., 2024). Notwithstanding the great value in developing an in-depth understanding and framing of interdisciplinary research, less is written about what interdisciplinarity means in practice, in *everyday research work* for the scholars engaged, but there is a growing wealth of very practical guidance (see, e.g., SHAPE-ID, n.d.; ITD Alliance resources, n.d.). Simple practical guidance is probably of more direct value to researchers who see interdisciplinarity as a means to an end rather than a concept to be explored, and are seeking approaches to working fruitfully together in an interdisciplinary team. In conservation science, effective interdisciplinary collaborations require careful consideration of the local social-ecological context for contributing to the improvement of the status of biodiversity and nature's contributions to people (cf. IPBES, 2022; Wyborn & Bixler, 2013). There is, however, a significant variation among biodiversity researchers when it comes to experiences of and insights into interdisciplinary work, with a substantial group of scholars less experienced in cross-disciplinary interactions that aspires for interdisciplinary collaboration and for which basic practical advice would considerably extend their chances of delivering valuable contributions.

The objective of this perspective is to contribute to advancing the practice of interdisciplinarity in biodiversity research, with a focus on bridging biological sciences and SSH. More specifically, the aim is to present some basic guidance that is comprehensible across diverse disciplines and valid for advising conservation practices, based on literature as well as experiences from a research project that aims not only to be multidisciplinary but also has high ambitions for effective interdisciplinary work, Land2Sea-integrated modeling of consequences of terrestrial activities and climate change for freshwater and coastal marine biodiversity and ecosystem services, with 28 researchers from 6 disciplines involved. We do not claim to make the ultimate instruction, but rather to provide insights that can guide interdisciplinary projects and also fuel further development of concrete advice.

There is a rich literature giving examples of challenges and frictions to overcome when engaging in interdisciplinary collaboration in biodiversity research involving natural sciences and SSH. Bennett et al. (2016) specify barriers related to ideologies, institutions, knowledge, and capacities as challenging mainstreaming of SSH in biodiversity research. Ideological barriers stem

from possible differing worldviews between SSH researchers and natural scientists, for example on the relationship between humans and the rest of nature (Endter-Wada et al., 1998; Sievanen et al., 2012). There have even been claims that there are incompatible epistemological and methodological differences, when it comes to, for example, using 'systems' for describing human societal aspects (Olsson & Jerneck, 2018) and qualitative versus quantitative approaches (Rusca & Di Baldassarre, 2019). Notwithstanding these challenges, a number of openings can also be detected in the literature (Rusca & Di Baldassarre, 2019).

*Land2Sea* was an international collaborative project that took place between 2018 and 2022, and included studies in Canada, Germany, Ireland, and Sweden. The overall objectives of Land2Sea were to develop an integrative framework of coupled models for predicting the immediate and long-term consequences of land use and climate change for the delivery of nature's contributions to people and the underlying biodiversity and ecosystem processes and co-design a mechanism for the application of the framework to environmental policy and practice. The international research team of 28 participants comprised marine and aquatic ecologists, ecosystem modelers, socio-cultural researchers and economists. For this paper, a survey, complemented by interviews, was undertaken on the project's researchers toward the end of the project in order to explore their experience of the interdisciplinary components of the project. For more description of the methods and of Land2Sea, see [Supporting Information](#). The following guidance for interdisciplinary research is based on both the results from the survey and the interviews and previous literature. The guidance is flavored by the authors' previous experiences from interdisciplinary work on conservation, having their various disciplinary expertise in ecology and qualitative social sciences.

## 2 | GUIDANCE FOR INTERDISCIPLINARY BIODIVERSITY RESEARCH

Fundamentally, interdisciplinary research projects consist of groups of individuals with certain skills, experiences, and personalities that have to interact in constructive ways if they are to deliver findings that are significantly more comprehensive than disciplinary research. We argue that for successful collaboration it is vital to recognize the differences between various disciplinary strands, in, for example, approaches, theories, methods, lingos as well as in basic understandings of the role of science, what *data* mean and how knowledge is established. This is especially important when

TABLE 1 Guidance for interdisciplinary work.

Aspects	Challenges	Ways forward
<b>People and personalities</b> <ul style="list-style-type: none"> <li>• Team composition</li> <li>• Attitudes and behavior</li> </ul>	<ul style="list-style-type: none"> <li>• Creating a good working culture</li> <li>• Creating trust</li> <li>• Intergenerational differences and career stages</li> </ul>	<ul style="list-style-type: none"> <li>• Careful composition of the group</li> <li>• Include some group members with previous experiences of interdisciplinary work</li> <li>• Listening skills—willingness to learn and to be challenged</li> <li>• Attitude to cooperate—not seeing differences as a problem</li> <li>• Curiosity—desire to understand the reasons, motivations and hidden meanings behind what people say or how and why they conduct research the way they do</li> <li>• Flexibility in using new approaches</li> <li>• Patience, including developing insights in what might need to be explained to collaborators about one's own field</li> <li>• Interest in real world problems and making an impact</li> <li>• Consider the role of young scholars</li> </ul>
<b>Process and organizing structure</b> <ul style="list-style-type: none"> <li>• Organization of work</li> <li>• Communication</li> <li>• Leadership</li> </ul>	<ul style="list-style-type: none"> <li>• Time consuming</li> <li>• Diverse ways of conducting empirical work</li> </ul>	<ul style="list-style-type: none"> <li>• Plan for interactions</li> <li>• Involve SSH scholars from the beginning</li> <li>• Allow enough time early on for understanding differences between the disciplines</li> <li>• Invest time in team building and bonding</li> <li>• Recognize and handle diverse ways of doing empirical work</li> <li>• Recognize and handle different publication processes and authorship</li> <li>• Build on previous experiences</li> <li>• Facilitators might be useful</li> </ul>
<b>Perspectives and concepts</b>	<ul style="list-style-type: none"> <li>• Differences in research methods</li> <li>• Differences in terminology</li> <li>• Differences in publication culture</li> <li>• Differences in ontology (What is data?)</li> <li>• Differences in epistemology (How is knowledge produced?)</li> </ul>	<ul style="list-style-type: none"> <li>• Recognize and handle the quantitative/qualitative divide</li> <li>• Map and handle differences in terminologies</li> <li>• Respect each other's disciplines and acknowledge disciplinary limitations</li> <li>• Discuss and establish a publication strategy early on</li> <li>• Strive for a joint framework</li> <li>• Allow for epistemological pluralism</li> </ul>

researchers working with qualitative and quantitative methods respectively are brought together (Rusca & Di Baldassarre, 2019). Having recognized some of the significant differences the next step is to handle the plurality. Since the project-specific contexts vary, as for example, engaged disciplines and research problems, there is no common and detailed blueprint for how to handle interdisciplinarity, but communication and dialog are clearly key (Marzano et al., 2006; Roy et al., 2013). Communication is time-consuming, and time is also of importance for broadening one's understanding and self-reflection. Shortcuts are incompatible with these required working practices. Instead, what is demanded is thoughtful organization of work, including fruitful measures such as face-to-face meetings, team building, and time and willingness to make intellectual investments that allow for theoretical and epistemological pluralism.

Table 1 presents a guide to help researchers better understand and prepare for interdisciplinary research endeavors in biodiversity. The guide is followed by a detailed description of the content of the guide. We sort the guidance into three interlinked dimensions: *People*

and *personalities*, *Process and organizational structure*, and *Perspectives and concepts*.

### 3 | PEOPLE AND PERSONALITIES

The *People and personalities* dimension is about both the composition of the team and the characteristics of the individuals, such as attitudes, behaviors and experiences of collaborative work (Derrick et al., 2011; Lindenfeld et al., 2012).

As for *team composition*, in the constitution of the Land2Sea team it was advantageous that some participants had previous experiences of interdisciplinary work. Their understanding of what interdisciplinarity entails helped in shaping the project and supported the establishment of a good team spirit. A work environment that was open to testing thoughts and expressions was especially needed for people to work constructively outside their knowledge comfort zone. One respondent told about consciously choosing to work with people he knew he could collaborate well with. In the same vein, others

stated that cooperation in the project was facilitated by the fact that some of the group members have worked together before rather than everyone being new. The risk that those already knowing each other will dominate needs, however, to be recognized. Having someone specifically tasked to facilitate interdisciplinary cooperation, for example, by running start-up workshops, and holding recurrent meetings for touch-basing and raising concerns merits consideration in large research projects (Graef et al., 2021).

When it comes to *attitudes and behavior*, beneficial mindsets involve having flexibility in approaches, keeping an open mindset to methods from other disciplines and being prepared to work through misunderstanding/confusion over concepts (Sanborn & Jung, 2021; Welch-Devine & Campbell, 2010). Moreover, interpersonal skills, such as cognitive, emotional, and interactional skills facilitate collaborative work by enhancing the understanding of cultural differences and disciplinary perceptions (Boix Mansilla et al., 2016; Cooper & Larson, 2020). Those skills include the capability to listen and the willingness to be challenged and learn new insights; seeing differences as opportunities rather than problems; and having patience and being attentive to what might need to be explained to collaborators about one's own field. Four key individual attributes were elucidated in the Land2Sea survey: openness, curiosity, listening skills and patience. In combination, these attributes meant having respect for each other's perspectives, a willingness to think outside one's own box and try new things, not seeing differences as problems but having a predisposition to interchange ideas and a willingness to learn and to be challenged. Furthermore, those attributes also connect to being self-reflective and developing insights about what might need to be explained to collaborators about one's own field. In Land2Sea, having some education or experiences from *the other side* proved to be helpful for understanding the differences that had to be overcome, and for knowing what questions to ask in the interdisciplinary collaboration. This might preferably include basic understandings about species, their living conditions and ecological context, as well as fundamental insights about humans, their various ranges of behaviors and the societal structures and dimensions that relate to land and water use. Having confidence in what is one's own contribution to the interdisciplinary endeavor, together with an allowance for others to bring their expertise to the table favored interdisciplinary collaborations.

One challenge brought forward by young scholars in Land2Sea was their role in the interdisciplinary interactions. The project was traditionally organized with PhD students and post-docs doing a significant share of the work, and the interdisciplinary exchange was

complicated by them being less experienced in their disciplinary fields, consequently having less confidence and skills to negotiate cross-disciplinary solutions. The reasonable way to avoid this situation would be for the senior researchers to be responsible for and together with the early career researchers to engage in the concrete interdisciplinary interactions.

## 4 | PROCESS AND ORGANIZING STRUCTURE

*Communication* is a key aspect in the dimension *Process and organizing structure*, entailing interactions and meetings characterized by an open and friendly discussion culture. Communication is interlinked with two other central aspects: *organization of work* and *good leadership* (Boone et al., 2020). Joint meetings in the conceptual stage of a project are vital, not only for finding common grounds but also for understanding differences. Crucially, time is needed for building working relationships as well as understanding and handling epistemological pluralism (Laborde et al., 2019; Persson et al., 2018). Researchers from all disciplines should, however, continuously be involved in interdisciplinary interactions in order to strengthen the scientific robustness of the results. Interdisciplinary biodiversity projects are commonly structured around case studies focusing on concrete geographical areas. This implies good potential in bringing together the researchers and jointly exploring how ecological and socio-economic dimensions co-evolve. Relatedly, effective leadership is a vital part of interdisciplinary work as it can build bridges, manage negotiations with open and honest discussions, maintain vision and innovation, and generate enthusiasm with flexibility and shared learning (Derrick et al., 2011; Palmer et al., 2016).

The interdisciplinary process in Land2Sea began in the project application phase, as scholars with different backgrounds were involved in the writing process. The project, then, started up with workshops, where joint frameworks and concepts were discussed. These meetings in the formative stage of the project were important, not only for finding common ground but also for understanding differences. As the participants had varying degrees of previous experience of interdisciplinary work, some needed more time to get acquainted with interdisciplinary cooperation. It demanded that the project members dared to start elaborating on issues and challenges with no or just vague ideas about the outcomes. Notably, while some liked this explorative way of working others expressed some frustration over it being too repetitive and inefficient. Anyhow, since the pandemic limited the options for in-person communication for Land2Sea, the

two face-to-face workshops held before the pandemic broke out proved to be valuable for personal communication and joint understandings in the virtual project environment that followed and led to more frequent meetings than were originally planned.

It turned out to be essential that the conversations also continued throughout the project, when designing field work and discussing the results. As the data collection began some differences, mainly between natural science and qualitative SSH, became increasingly challenging, along with the variation of disciplinary mixes of researchers in the case studies in Land2Sea, economics and marine ecology; fresh water ecology, marine ecology, civil engineering, geography and English literature; marine ecology and human geography; fresh water ecology and human geography; and the possibilities of combining results from different disciplines. The case studies pragmatically, then, developed slightly different approaches to the joint frameworks and concepts, also using different methodologies, all adapted to the set of competencies among the researchers engaged in the respective case study and also to the specific place-based contexts.

While allocating substantial time for discussions in and between the joint meetings in the beginning and middle phases of the project was a success factor for the interdisciplinary component in Land2Sea, the lack of time in the latter phases for further discussions and knowledge synthesizing was an obstacle for further merging and interlinking the biological insights and the socio-economic ones in theories and methodologies. Similar to most research projects the issue about delivering publications became increasingly important, and the delivery phase somehow implied a push-back for interdisciplinarity. While integrated data sets, as in the Decision support tool that was created, and joint authorships nurtured interdisciplinarity, different publication processes and different approaches to authorship were complicating factors. One lesson learnt for future interdisciplinary projects is to start thinking about joint papers or other shared outputs fairly early, preferably already during the application phase. The emerging pressure for deliveries came with frustration among the researchers in realizing that they had reached the point of how far the innovative interdisciplinary thinking could be taken in Land2Sea. It would have been favorable to have had similar joint discussions in the end as in the beginning, having time to make synthesis and reflecting on what lessons had been learnt. There was, however, also a more satisfying recognition towards the end that the integrative accomplishments made during the project, for example, the integration of quantitative and qualitative data in the Decision support tool, were a stepping stone for further

developing and refining the integration of quantitative and qualitative data in future projects.

## 5 | PERSPECTIVES AND CONCEPTS

Interdisciplinary work often requires embracing various methods, approaches, and ways of doing analysis, all of which can lead to frustrations due to differences in understandings. As for *methodologies*, there are ontological and epistemological barriers to be handled, with one key division being between quantitative and qualitative research. Foundational disparities in approaches to data and information types might well be part of these kinds of tensions, including underlying assumptions about the validity of others' research as well as the perceived moral superiority of one's own methodological approach (Lélé & Norgaard, 2005; Pooley, 2013). In particular, qualitative data have often been viewed as *subjective and anecdotal* by natural scientists, and quantitative methods considered to be superior (Cooper & Larson, 2020). In conservation research there are longstanding hierarchal attitudes and rhetorics. Frictions can also form from the perceptions that natural scientists might have of the role and function of SSH researchers (Campbell, 2005; Sanborn & Jung, 2021; Urbanska et al., 2019). Commonly, SSH researchers experience the subordination of SSH knowledge to solving problems framed in natural science terms instead of contributing on their own terms and also the tokenization of SSH researchers, i.e. their participation legitimates the interdisciplinarity of a project, but they are only granted a marginal role. As a result, many SSH researchers are reluctant to collaborate on conservation projects. Issues raised in the literature are, for example, obliviousness to SSH of natural scientists and to the great variety between different SSH disciplines and approaches; studies of humans and human society of deficient scientific quality due to insufficient applications of appropriate approaches, theories and methods; the lack of thorough reflections on concepts and framings, recognizing the subjectivity in terms such as *nature*, *systems'* and *ecosystem services*, and the consequences of using them (Fischer et al., 2025; Fox et al., 2006; Holmes et al., 2021; Viseu, 2015). Central means for improvements are better recognizing the differences between various strands of science, transparent and self-critical reflections, and also intellectual humility in research (Fischer et al., 2025).

In Land2Sea, *language* differences showed between scholars from natural sciences and SSH when presenting perspectives and how the interdisciplinary interaction around frameworks, concepts and joint outputs played

out. Notwithstanding that SSH researchers recognized SSH components in the application, and in the work packages, they perceived a bias toward natural sciences, for example, in the research design being a bit linear with one-directed cause-effect thinking from ecological state to socio-economic consequences instead of acknowledging an interlinked co-evolution. Also, differences in terminology turned out to be a challenge. These differences were not only about distinct features studied in the various disciplines, but also concerned that the same term had different meanings in different disciplines. A potential solution to this challenge is to create a joint glossary of key terms and concepts used in the different disciplines involved at the outset of the work (cf. Laborde et al., 2019).

Differences in *research cultures* was another obstacle in Land2Sea, including difficulties due to the fact that some scholars had to a marginal degree reflected on the limitations in their own disciplines that, for example, sometimes meant that work on analysis and model constructions had to be rolled back in order to appropriately acknowledge SSH perspectives and insights. Notably there were also differences between disciplines within natural sciences, for example, between fresh-water ecology and marine ecology, and within SSH, for example, between economics and research based on non-numerical methodologies. Those differences were addressed in a number of ways, for example, through the allowance for multiple perspectives and the efforts to develop common frameworks and sharing of tools. The joint elaboration on some end results and products, following the project design, created an opportunity for interdisciplinary collaboration. In particular, a significant amount of time and energy was invested in discussing how to develop joint analytical approaches. In the beginning the ambition was to merge two different analytical approaches (the Bayesian Belief Network [BBN] and the Bow-tie model [BT]) into one framework. In those discussions ecological quantitative modeling approaches and qualitative social science approaches were brought together. Project members working with qualitative approaches appreciated that the modelers were open to redesigning the models instead of squeezing the data to fit a predefined model that they had experienced in previous collaborations. This interaction resulted in the development of slightly different approaches and methodologies used in the various case studies, with, for example, the Irish case having an emphasis on maintenance of populations of wildlife and of water quality while the Swedish case leaned toward the relationship between the condition of the coastal ecosystem and socio-cultural and economic interests. These differences were well accepted in the project, and some of the respondents claim that

the strength of Land2Sea was allowing this variation. Interdisciplinary efforts were also invested in developing a decision support tool for practitioners. As such it stimulated the participants to reflect on how the interdisciplinary learning played into and strengthened the societal relevance of the outcomes, for example, on how to communicate both quantifiable measures and non-measurable aspects.

Differences between the participants in this study on interdisciplinarity were also apparent in their view on *knowledge creation*, apparent, for example, in the joint work on the analytical approaches and on the tool for practitioners. The natural scientists described the achievements made for both the approaches and the tools as important contributions that were shared and explained well. In contrast, the SSH scholars, had a greater interest in the exploration of what the approaches and the tool could and could not deliver in terms of nuanced socio-economic aspects, and also their roles as integrators for discussion and boundary objects. Hence, to the SSH scholars it was, for example, secondary whether or not the decision support tool could work in practice. For them, the main value of the tool was instead that it opened up for reflections on what is applicable in practice.

## 6 | CONCLUDING REFLECTIONS

The calls for interdisciplinary research to address the nature crisis come from the recognition that nature conservation to a significant degree is about human society. The IPBES assessment on transformative change, published in December 2024, reinforces the arguments for enhancing interdisciplinary work by stating that *Underlying causes are deeply rooted and interconnected social and cultural patterns that shape, influence and reinforce all direct and indirect drivers of biodiversity loss* (IPBES, 2024, p. 12). The guide offered in this paper presents concrete advice for how to carry out interdisciplinary studies that are both scientifically credible and relevant for conservation practice. A key stand point in the guide is to recognize the differences in ontologies, epistemologies, approaches, methods, and framings among the scholars in a research team as strengths and to provide outputs to policy and practice that reflect and honor the synthesized disciplinary contributions.

## AUTHOR CONTRIBUTIONS

Stenseke is the main author of the manuscript. She has contributed to the idea. She carried out the survey and the interviews of experiences of interdisciplinarity in the project Land2Sea, and analyzed the collected data.

Lowther Harris assisted with the literature search. He has also provided valuable input to the whole manuscript. Crowe is the main author of the supporting material on Land2Sea. He has also provided valuable input to the whole manuscript.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data from the survey and the transcripts from the interviews in the study of experiences of interdisciplinarity in the project Land2Sea can be available upon request, if ethical standards for sharing personal data have been assessed and fulfilled.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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