

Supplemental material for

“Designing Inter- and Transdisciplinary Research on Mountains: What Place for the Unexpected?”, by Iago Otero, Frédéric Darbellay, Emmanuel Reynard, György Hetényi, Marie-Elodie Perga, Janine Rüegg, Günther Prasicek, Marina Cracco, Amaranta Fontcuberta, Michiel de Vaan, Javier García, Jonathan Bussard, Christophe Clivaz, Christine Moos, Antoine Guisan, Bettina Schaepli, Nicola Mapelli, and Benoit de Bellefroid, published in *Mountain Research and Development* 40(4), 2020. (See <https://bioone.org/toc/mred/40/4>)

APPENDIX S1 Defining multi-, inter-, and transdisciplinarity.

There are three distinct but complementary stages in the dialogue between disciplines: multidisciplinary, interdisciplinarity and transdisciplinarity (Darbellay et al 2014: 2-3). Based on these authors, the following definitions are used in our paper:

- **Multidisciplinarity** is aimed at studying an object or solving a theoretical or practical problem by resorting to two or more unconnected disciplines in succession, without any real interaction between them. It reflects the traditional institutional juxtaposition of a plurality of specialist communities organized in faculties, departments, etc. (compartmentalization of science).
- **Interdisciplinarity** goes further than simple juxtaposition: the disciplines interact in a dynamic way to understand the complexity of an object or to solve a theoretical or practical problem. A common research object is co-constructed through a dialogue between the involved disciplines on the basis of existing competencies. Such research object remains irreducible to any of the disciplinary viewpoints. The mentioned dialogue requires researchers to deploy the analytical skills and tools of their own discipline while opening their minds to the methods of the others’.
- **Transdisciplinarity** refers to a knowledge process that crosses and transcends disciplinary boundaries, entailing a major reconfiguration of disciplines in an encompassing perspective. In its more participatory and applied version, transdisciplinarity is a research procedure that integrates political, social and economic stakeholders as well as ordinary citizens into a problem-solving approach. In this version, non-scientific stakeholders are encouraged to actively participate in the co-construction of knowledge and the resolution of complex (wicked) social problems (e.g. climate change). Transdisciplinarity also applies to the exploration of the complex relations between different scientific cultures (technological, life and natural sciences on the one hand, and humanities and social sciences on the other).

From multi- to inter- to transdisciplinarity there is thus a reasonably coherent epistemological gradient whereby disciplines (and eventually non-scientific knowledge) are incorporated into a relational network that becomes progressively denser, more interactive and more integrated (see Darbellay et al 2014).

REFERENCE

Darbellay F, Moody Z, Sedooka A, Steffen G. 2014. Interdisciplinary research boosted by serendipity. *Creativity Research Journal* 26(1):1–10. doi:10.1080/10400419.2014.873653.

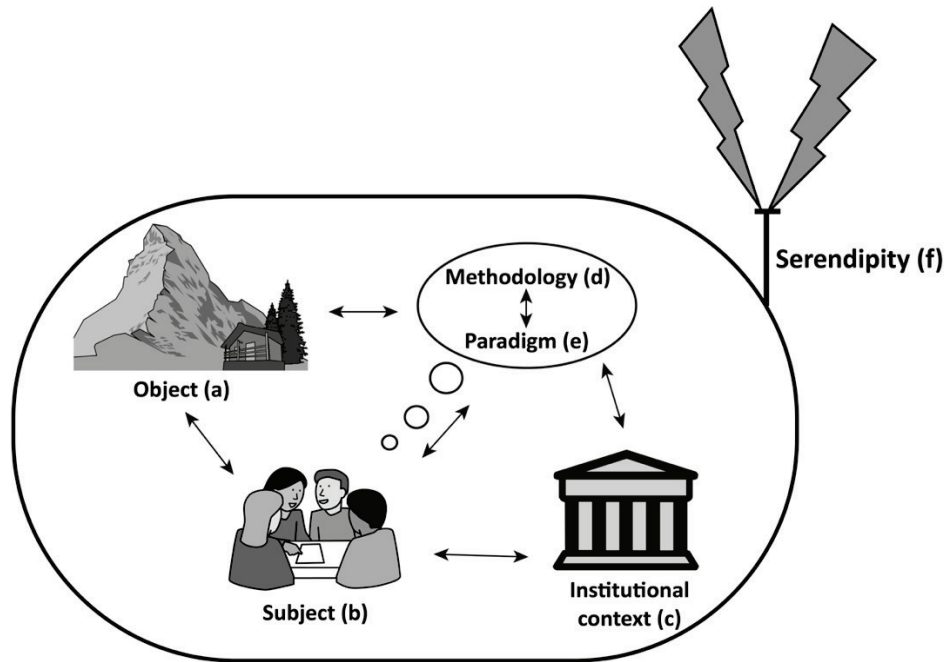
APPENDIX S2 CIRM's research projects analyzed in the paper.

Title	Type	Duration
1. L'impur de la montagne. Une histoire des pollutions industrielles dans la vallée du Rhône au 20ème siècle	CIRM funded postdoc	2019-20
2. Droit et territoires de montagne	Faculty research	No specific duration
3. Les Romains dans les Alpes	Faculty research	No specific duration
4. Les refuges comme observatoire de la transition récréative en haute montagne	CIRM seed funding	2019
5. MOUNTAINCRAFT: Gaming the future of mountain environments to foster climate adaptation initiatives	CIRM seed funding	2019
6. Géostatistique de la microtoponymie et reconstruction du paysage, à l'exemple d'Ormont-Dessus (Vaud)	CIRM seed funding	2019
7. Quantifying the temporal evolution of the protection service of forests against rockfall in the face of climate change	CIRM funded postdoc	2019-21
8. Ice and Erosion Dynamics at the Gorner glacier, Zermatt	CIRM funded postdoc	2019-21
9. Geological and glacial processes at the Gorner Glacier, Zermatt	CIRM seed funding	2019-20
10. The freshwater continuum: function and structure of lotic-lentic and lentic-lotic transition zones	CIRM funded postdoc	2019-21

Project numbers refer to Figure 2.

CIRM: French acronym of Interdisciplinary Centre for Mountain Research (University of Lausanne)

APPENDIX S3 Model of inter- and transdisciplinary research.



a) **Object:** *What are we researching?* It includes research topics, study regions, and scales.

b) **Subject:** *Who/what are we?* It includes researchers' motivation for inter-/transdisciplinarity, cost and added value of inter-/transdisciplinarity for their careers, and disciplines and stakeholders involved.

c) **Institutional context:** *What kind of institutional support do we have?* It includes the institutional mission, organization, resources, collaboration networks at different scales, and evaluation procedures provided by the research center and the university.

d) **Methodology:** *How do we study the object?* It includes the methods and approaches used to articulate disciplines and non-academic knowledge in inter- and transdisciplinary processes, as well as teamwork.

e) **Paradigm:** *What are we doing?* It includes researchers' visions of work across scientific disciplines and knowledge types.

f) **Serendipity:** *How can we capitalize on unexpected discoveries?* It includes unexpected happenings and observations regarding model components a-e and the degree to which they are exploited in creative avenues.

Source: Our own ideas and Darbellay et al (2016).

REFERENCE

Darbellay F, Sedooka A, Paulsen P. 2016. *La recherche interdisciplinaire sous la loupe: Paroles de chercheurs*. Bern, Switzerland, Berlin, Germany, and Brussels, Belgium: Peter Lang.

APPENDIX S4 Factors that may favor or hinder serendipity in a research center on mountains.

Factors favoring serendipity	Factors hindering serendipity
<ul style="list-style-type: none"> – Allocate a % of time for social and inter-/transdisciplinary interactions in the employees' contract specifications. – Train "ambassadors": expose PhD students and postdocs to a serendipitous working environment to make them transformative agents in their subsequent institutions. – Organize events for interdisciplinary exchange at different levels (center, postdocs, etc.). External facilitation enables fruitful work. – Promote knowledge of other ways of working: researchers can be encouraged to join a fieldwork trip of a colleague, eventually without internet connection. – Encourage researchers to not be ashamed of asking naive questions to colleagues from different disciplines. – Spread curiosity and skepticism among the center's values. – Promote interaction with stakeholders of mountain territories (natural parks, regional museums, cultural and environmental associations) in bottom-up approaches to define new research questions. – Reinforce popular science initiatives: feedback from citizens can trigger thoughts and research questions in scientists. – Encourage writing of perspective and overview articles on pioneer fields by young researchers, mentored by senior researchers. – Promote interactions with other interdisciplinary centers of the University of Lausanne. – Promote interactions with other research centers on mountains at the national and international levels. 	<ul style="list-style-type: none"> – Tight and/or inflexible deadlines for projects, reports, papers, etc. – Isolation of people and research ideas. – Lack of social interactions. – Hierarchies, authoritarian behaviors and elitism in knowledge production and organizational management. – Pressure to publish ("publish or perish"). – Pressure to innovate that can hinder replication. The latter is necessary for unexpected outcomes to emerge. Yet a journal can reject a paper that replicates a method with the argument of not being innovative enough.

Source: Our own ideas.