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Mobilizing transdisciplinary collaborations: collective reflections on *decentering academia* in knowledge production

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Non-technical summary. Global sustainability challenges and their impact on society have been well-documented in recent years, such as more intense extreme weather events, environmental degradation, as well as ecosystem and biodiversity loss. These challenges require a united effort of scientists from multiple disciplines with stakeholders, including government, non-government organizations, corporate industry, and members of the general public, with the aim to generate integrated knowledge with real-world applicability. Yet, there continues to be challenges for these types of collaboration. In this commentary, we describe processes of collective *unlearning* that serve to *decenter academia* in collaborations leading to a more equitable positioning of practitioners engaged in collaborative global sustainability research.

Technical summary. Increasing attention to transdisciplinary (TD) sustainability science has shaped the joint work of researchers and practitioners currently addressing pressing global sustainability problems. In this short commentary, we describe and discuss an international TD collaboration and draw upon the authors' experiences after 5 years of ongoing collaborative work in the realm of global sustainability research in the Americas. Our collective experience illustrates that processes of *unlearning* serve to *decenter academia* in TD collaborations leading to a more equitable positioning of practitioners engaged in TD research. Participating in social *unlearning* practices that aim to deconstruct and disrupt institutionalized scientific norms and challenge entrenched institutional structures may hold the key to mobilizing TD research for solution-oriented placed-based social-ecological research.

The participatory approach to knowledge production at the center of transdisciplinary (TD) science arguably has immense potential to improve responses to wicked global sustainability challenges with the goal of generating societal and ecological benefits (Cornell *et al.*, 2013; Mauser *et al.*, 2013; Djenontin & Meadow, 2018). TD science is characterized by research collaborations between academics and actors beyond academic arenas. Policy and scientific initiatives that advance TD collaboration and synergistic interactions among scientists and other producers and users of knowledge increasingly inform the global landscape of research, policy, and practice in sustainability science and global environmental change (Lang *et al.*, 2012; Balvanera *et al.*, 2017). Institutional administrative policies and cultures of research and education also reflect the growing influence of and an increasing commitment to transdisciplinarity, as do national and international funding bodies that support scientific innovation (National Research Council, 2014; 2015; Inter-American Institute for Global Change Research, 2017; International Science Council, 2017).

Rhetorical discourses for best practices and innovation in sustainability-oriented science urge collaboration, synergy, and transgression across traditional disciplinary boundaries and the inclusion of actors beyond academia (Klein, 2014; Tejedor, Segalas & Rosas-Casals, 2018). And while practitioner involvement in sustainability research is growing, the realization of spaces for these types of actors to occupy more equitable positions in sustainability research processes remains rare (Brandt *et al.*, 2013). Furthermore, in practice, TD sustainability science often faces challenges arising from slow institutional change and immature support structures for researchers (Rikakis, 2009; Halevi, 2012). For example, it has been reported that collaborative work in science customarily necessitates a difficult process of breaking through individual epistemological and cognitive orientations to find common ground (Ramadier, 2004; Hall *et al.*, 2012). This process entails acknowledging and integrating different, and often conflicting, approaches to formulating research problems, developing shared conceptual toolkits, and designing protocols to structure inquiry-based activities, including data collection and analysis

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(Pohl & Hadorn, 2008; Balvanera *et al.*, 2017; Pischke *et al.*, 2019a). Furthermore, collaborative endeavours are often nested within institutional and organizational settings that are generally poorly equipped to enable innovative strategies for collaboration (Stokols *et al.*, 2008; Mauser *et al.*, 2013). These multiple micro (individual) and macro (institutional and organizational) dimensions add to the complexity of successfully operationalizing transdisciplinarity within sustainability science and practice.

Notably, within the sustainability science scholarship, transdisciplinarity has itself been described as a ‘wicked problem’ (Norris *et al.*, 2016) due to the need to navigate complex governance issues across various individual and institutional domains. Despite these challenges, the profile of transdisciplinarity is being elevated as a pathway forward to address pressing global sustainability problems. As a result of ongoing shifts in research funding and institutional priorities, an increasing number of individuals and teams are experimenting with strategies to engage and open equitable spaces for a broad range of diverse stakeholders and knowledge users to co-create place-based, solution -and transformation-oriented research (Podesta *et al.*, 2013; Steelman *et al.*, 2015; Balvanera *et al.*, 2017).

In this short commentary, we describe and discuss a multi-national TD collaboration, drawing upon the authors’ experiences after 5 years of collaborative work investigating how established teams negotiate the process of conducting place-based social-ecological research in a global sustainability context. The research collaboration described in this study was established on the basis of grant-funding specifically targeted to building TD research capacity in global environmental change science among early career scientists and practitioners across the Americas region. We analyse and reflect on how being part of a diverse group – both epistemologically and in practice – has shaped the ways in which we engage with each other, co-design research, overcome conflict when it arises, and reflect on the profound transformations occurring within key institutions through our own experience with long-term collaboration.

We situate our commentary within current scholarship in Science of Team Science (SciTs) and social experiential learning to describe and reflect on our participation in a multi-year TD collaboration (Wenger, 2000; Fernandez-Gimenez *et al.*, 2008; Fiore, Phillips, & Sellers, 2014; Christie, 2017; Parker, Racz, & Palmer, 2018). For decades, a radical change in the way that knowledge is produced has been taking place. Knowledge production is no longer solely affiliated with individual disciplinary contexts, nor limited to academic institutions. Rather, there is growing attention to knowledge that is produced within open and shifting organizational boundaries with an expanding scope of participating actors (Pischke *et al.*, 2019b). Furthermore, knowledge production in sustainability science is increasingly oriented towards broader impacts that translate research outcomes into policy and practice to achieve particular, useful, and actionable ends (Hadorn, Pohl & Bammer, 2010; Brandt *et al.*, 2013; Chan Nuñez, 2015; Toikka, Miettinen, & Tuunainen, 2016; Parker, Racz, & Palmer, 2018). Central to action-oriented TD teamwork is a process of social experiential learning described as “an intentional process of collective self-reflection through interaction and dialogue among diverse participants or stakeholders” (Fernandez-Gimenez *et al.*, 2008, p. 22). This suggests that TD knowledge production is practice-based, formed through action, experience, and joint reflection of the members involved (Parker, Racz & Palmer, 2018).

Theorizing processes of collective learning in TD collaborations is a growing area of research attention (Gerlak & Heikkilä, 2011; Herrero, Dedeurwaedere, & Osinski, 2018). Within the contours of the Latin American TD scholarship, we note synergies and divergences from European approaches to collaborative research. An area of alignment between the bodies of thought is increasing visibility of processes of social learning in long-term collaborative research networks. An area of thought we find emphasized more in the Latin American scholarship is attention to the role of and possibility afforded by deconstruction and challenging epistemic power structures. Chan Nuñez (2015) describes ‘knowledge ecosystems’ as groups of collaborators who draw upon varied types of knowledge produced by distinct communities of practice, only partially relying on the knowledge production process followed by academic scientists. Espinosa Torres, & Pons Bonals (2015) introduce the concept of ‘de-constructors’ to describe the responsibility of academic actors engaged in community-based TD research collaborations to expose hidden assumptions and contradictions of instrumentalist approaches to knowledge production.

Following this literature, we argue that, in order to truly engage in TD work, all actors involved – especially academics – need to participate in processes of deliberate social *unlearning*, to enable the *decentering* of academia in both the processes and politics of TD knowledge production and knowledge translation. Thus, for us, social *unlearning* serves as a method to *decenter* academia. That is, a deliberate process of acknowledgement, removal and replacement of academia-driven precepts, canons and practices from a primary or central role in any TD process of joint work. This intervention argues that when the place of academia is *decentered* within TD collaboration, attention is drawn to other ways of engaging the world and aims to jointly open spaces for other knowledge communities to take on active roles. Consequently, *decentering* academia offers opportunities for the emergence of alternative forms of knowledge production and for actors beyond academic arenas to engage more meaningfully in the collaborative process of TD work. Our intention is not to invite a wholesale rejection of academic culture and knowledge production systems in TD work. Rather, our aim is to recognize that processes of *decentering* academia in collaborations that bring together academics, practitioners, and others, may facilitate a genuine openness to ascertain knowledge claims brought up by diverse actors and allow us to join other communities in their unique practices of knowledge production.

It is surprising that few first-hand accounts exist of teams’ learning experiences as a site for inquiry (for a few examples see, Binder, Absenger-Helmi, & Schilling, 2015; Espinosa Torres, & Pons Bonals, 2015; Pischke *et al.*, 2017), especially given the rapidly expanding body of TD research within team science, in particular the role TD collaborations play in shaping current generations of scientific knowledge (Fiore, 2008; Wuchty, Jones, & Uzzi, 2007; Hall & O’Rourke, 2014), and the opportunities these collaborations provide to inform policy and practice (Pregernig, 2006; Stokols, 2006; Falk-Krzesinski *et al.*, 2010; Schnapp, 2012). This gap in the existing body of TD scholarship is significant, as there are insufficient accounts that capture the TD team experience and social experiential learning dynamics from the perspectives of the team members themselves. Describing the stories, tools, and formal and informal learning processes of teams engaged in the practice of TD sustainability science has the potential to provide important insights.

We used a qualitative narrative approach (Clandinin *et al.*, 2009; Espinosa Torres, & Pons Bonals, 2015) as the foundation for our inquiry into social experiential learning and TD teamwork in the context of global sustainability research in the Americas region. This approach provided a framework to capture and reflect on our experiences and to reveal the uniqueness of our teamwork processes, while allowing us to be active narrative storytellers and narrative analysts. Data for the inquiry included informal conversation notes, e-mail messages, field notes, and focus group transcripts. We employed thematic analysis to examine the data collected, identifying key patterns that occurred in and through our collaborative learning processes. Data analysis also focused on detecting narrative passages that spoke to the larger institutional and organizational boundaries of our work.

Our six-member team first met in 2014 as a result of a two-part intensive international TD capacity building workshop series led by an international funding agency. This initial shared training experience enabled us as uniquely positioned to observe and evaluate our collaboration through a TD lens. Since 2014, the team has collaborated on several projects exploring large, international scientific collaborations that address place-based sustainability challenges and global environmental change in the Americas. Our team is a practice-oriented research group characterized by high levels of international, cultural, gender, disciplinary, and academic-practitioner diversity. Three of the six members of our team belong to policy and practice sectors: 1) a non-governmental environmental conservation organization, 2) an intergovernmental funding agency, and 3) a member of the Ministry of Environment in a South American country. Two members are assistant professors currently affiliated with universities in North America and one member is completing his doctoral degree in a university in New Zealand. The majority of the team members are Latin Americans, with one member from the US. Three of the team members are female, and three are male. The team members also represent diverse disciplinary backgrounds spanning the natural and social sciences and architecture.

In the next section, we provide three examples drawn from our team's collective reflections to illustrate how we experienced processes of social *unlearning*, including challenging taken for granted power structures, and *decentering* academia. In the final section, we highlight insights gained from these experiences and the potential to contribute to new avenues in TD sustainability science.

1. Decentering academia through social *unlearning*

A consistent theme across our narratives refers to a shared interest in structural transformation, focused on practical attempts to challenge and transform the institutional structures of which we are a part and that shape our professional activities, including for example traditional funding conventions for global sustainability research. As we see it, this required our team to engage in deliberate processes of *unlearning* well-established organizational routines to transform and readjust procedures, systems, and processes that we previously considered conventional and taken for granted.

In the first example, the team member affiliated with the intergovernmental funding agency shared her interest in revising the funding infrastructure for collaborative research networks, to better support the integration and equitable positioning of practitioners and actors beyond academia in action-oriented TD sustainability research. For instance, while an orientation towards

collaborative, community-based research had been a defining feature of the funding agency she is affiliated with, the communication channels for promoting grants and disseminating calls for proposals was dominated by academic listservs and mailing lists mostly targeting senior and established scholars in the natural sciences. However, the results of funded projects that emerged from this engagement strategy (i.e. primarily targeting well-established, senior-career natural science academic actors) tended to fall short of the proposed TD outcomes for collaborative knowledge production and knowledge translation laid out in the research proposals. As a result of engaging in collaborative social learning experiences with our team and the research findings that emerged from our work, the funding agency is now in the process of broadening their audience and targeting young professionals from a wider variety of fields and sectors in their TD capacity-building workshops and research funding calls for proposals.

In a second example, the members of the team who are early career professionals affiliated with universities identified an interest to challenge the formal controls and normative regulations that structure our academic activities within our institutions. This process involved acknowledging, questioning, openly discussing, and at times, challenging the parameters and practices of our own disciplines, as well as, the set of practices, traditions, and habits of mind that go along with being trained in, and becoming professionals who work within, the academy. For example, in order to attempt to engage in collaborative work, we had to *unlearn* previous training in our own narrow disciplinary and methodological niches. Most of our career training in academia consisted of valuing specialized knowledge, developing disciplinary-specific methodological practices, and achieving a stable epistemological affiliation and disciplinary identity. In such an intellectual environment, building TD collaborations was foreseeable by many of us as possible only if built on top of our own disciplinary foundations, guided by our strong academic and disciplinary identities (i.e. geographer, educator, agronomist). However, our shared TD work invited us to discuss, and ultimately deconstruct, our established bodies of knowledge and their associated practices of knowledge production in more depth. These processes of disciplinary deconstruction challenged each of us to reconsider the value we assign certain epistemic traditions over others and how these values were reflected in and served to shape how we designed our collaborative work.

In designing the methodology of our research, early in our collaboration, the multi-national team came together face-to-face to develop a survey instrument to be implemented during the first phase of research data collection. On this occasion, a significant dialogical clash flared between academic scientific worldviews and practitioner perspectives focused on epistemological value judgements, or put another way, what forms of knowledge count. In this example, academic team members overwhelmingly placed significant value on knowledge produced through evidence- and data-based factual information, while practitioners' perspectives tended to value experiential and anecdotal forms of knowing as also having legitimate credibility. To succeed in collaboratively designing our survey instrument in a manner that would strengthen, rather than erode trust between team members, we had to productively resolve this inter-team conflict. We assumed a critical deconstructive process to elicit, disclose, question, and discuss our own epistemological values and how they shape the way we each see and interpret the world. Through this collective experience we were able to identify and deconstruct what each of us had taken for granted in our disciplinary training

Table 1. Insights from collective, team-based reflection on the role of social *unlearning* processes to mobilize solution-oriented transdisciplinary research for global sustainability challenges.

Examples	Barriers	Enablers	Insights to mobilize solution-oriented TD research
TD funding agency dissemination strategies	Dissemination strategies targeted a narrow, specialized audience of senior natural scientists	Design dissemination strategies targeted at wide, diverse audiences (junior and senior scientists, practitioners, diverse disciplines across natural, social and engineering sciences)	Funding agency's openness to reflective dialogue and flexibility to <i>unlearn</i> previous practices, <i>decenter</i> academia, and steer the organization in new practical directions
Epistemological clashes in TD research design (i.e. designing protocols for data collection and analysis)	Academic-centric value systems and priorities for what knowledge counts in research design	Deconstruct academic epistemologies, recognize and value knowledge systems beyond academia, and provide space for other ways of knowing to contribute to TD research design	<i>Deconstructing</i> and <i>decentering</i> academic ways of knowing enables the equitable positioning of practitioners and other diverse actors beyond academic arenas to move beyond token participation and take leadership roles in the research process
Protocols for respectful engagement with indigenous knowledge holders	Strict funding agency budget rules and academic financial accounting structures are misaligned with respected protocols of engagement	Acknowledge and respect indigenous protocols in funding practices, including budget templates, funding categories, and institutional rules for funding expenditures	<i>Unlearning</i> academic norms and priorities that structure knowledge production, create space to challenge, adapt, and ultimately revise strict and rigid funding categories

and what we considered to be conventional in how work is conducted in our own fields. This process of social *unlearning* – characterized by a shared, intentional departure from previous routines and systems of meaning associated with our individual professional practices – enabled a number of important shifts in our TD collaboration. By *decentering* academia in the research design process, *deconstructing* taken-for-granted discipline-based assumptions, and *renegotiating* the value assigned to other-than-academic ways of knowing, actors beyond academic fields were able to move beyond a token participation role to take key leadership roles in shaping the research design.

Finally, a third example concerns the inclusion of indigenous community members as genuine collaborators within our TD work. This example illuminates the ways that following respected protocols of engagement with indigenous communities can unexpectedly challenge entrenched institutional structures and practices in both academia and funding agencies. For example, there exist guidelines for connecting appropriately with keepers of traditional knowledge and cultural resource experts in indigenous communities. These guidelines clearly outline cultural observances to be followed by members of academia and other sectors who attempt to engage and conduct participatory research with traditional knowledge keepers and cultural resource experts. These protocols for collaboration and sustained dialogue include guidelines for invitations, honoraria, and offerings. Yet, aligning the protocols of engagement with strict funding agency budget rules and academic institutional structures for financial accounting has proven in our experience to be difficult. Often, such budget templates and financial guidelines for fund expenditures are rigidly designed to respond to and prioritize academic practices of knowledge production and translation, explicitly prohibiting the use of funds for cultural practices of reciprocity associated with gift-giving and other offerings to compensate the sharing of indigenous expertise and traditional ecological knowledge. To provide space for the genuine inclusion, acknowledgement, and equitable positioning of indigenous knowledge holders in collaborative TD research processes, it is necessary to engage in additional processes of social *unlearning*. In this specific case,

to *unlearn* academic norms and priorities that structure knowledge production by challenging, adapting, and revising the strict and rigid funding categories that do not recognize respected indigenous cultural practices of research engagement.

In Table 1, we provide a chart/written record of the accounts we have outlined in this commentary.

2. Conclusion – new possibilities for TD collaborations

In conclusion, our collective experience illustrates that processes of social *unlearning* produce the space and possibility for performing small acts aimed at *decentering* academic privilege and *deconstructing* academic power structures in the politics of TD knowledge production that may enable radical positive change. Our provocation contends that social *unlearning* provides a strategic approach to *decentering* academia in TD collaborations, a challenge that remains particularly difficult to solve in practice (Polk, 2014). Thus, we argue that social *unlearning* practices such as *deconstructing* and *disrupting* institutionalized scientific norms and *challenging* entrenched institutional structures may hold the key to mobilizing alternative landscapes of TD place-based social-ecological research that is able to more effectively address and resolve global sustainability challenges. However, this process of social *unlearning* needs to occur within well-structured and carefully designed spaces of learning and collaboration that emphasize principles of good practice, including dialogue, interaction, trust, and ethical practice (Wenger, 2000; Fernandez-Gimenez *et al.*, 2008). Acknowledging the inevitability of researchers' standpoints has implications that extend far beyond the reflections and examples from our team's experience offered here; to focus attention on ethical issues concerning the significant responsibility sustainability researchers have in the constitution and legitimation of moral and political frameworks and assumptions. We invite those currently working in the contexts of global sustainability, to pay attention to the types of structural and institutional transformations that TD work enables and the opportunities for democratic practices that TD spaces provide for meaningful participation and equitable positioning of diverse

actors through joint work to resolve pressing social-ecological sustainability problems.

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All co-authors contributed ideas and insights about their experiences in the team's TD efforts and reviewed the final manuscript.¹

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Note

¹ Brand, A., Allen, L., Altman, M., Hlava, M., & Scott, J. (2015). Beyond authorship: attribution, contribution, collaboration, and CRedit. *Learned Publishing*, 28(2), 151–155. <https://casrai.org/credit/>

References

- Balvanera, P., Daw, T. M., Gardner, T. A., Martin-Lopez, B., Norstrom, A. V., Speranza, C. I., Spierenburg, M., Bennett, E. M., Farfan, M., Hamann, M., Kittinger, J. N., Luthe, T., Maass, M., Peterson, G. D., & Perez-Verdin, G. (2017). Key features for more successful place-based sustainability research on social-ecological systems: a Programme on Ecosystem Change and Society (PECS) perspective. *Ecology & Society*, 22(1), 14.
- Binder, C. R., Absenger-Helmli, I., & Schilling, T. (2015). The reality of transdisciplinarity: A framework-based self-reflection from science and practice leaders. *Sustainability Science*, 10(4), 545–562.
- Brandt, P., Ernst, A., Gralla, F., Luederitz, C., Lang, D. J., Newig, J., Reinert, F., Abson, D. J., & von Wehrden, H. (2013). A review of transdisciplinary research in sustainability science. *Ecological Economics*, 92, 1–15.
- Chan Nuñez, M. A. (2015). Comunidades y redes académicas en los ecosistemas de conocimiento. *Archivos de Ciencias de la Educación*, 9(9), 1–16.
- Christie, S. (2017). Structure mapping for social learning. *Topics in Cognitive Science*, 9, 758–775.
- Clandinin, D. J., Murphy, M. S., Huber, J., & Orr, A. M. (2009). Negotiating narrative inquiries: Living in a tension-filled midst. *The Journal of Educational Research*, 103(2), 81–90.
- Cornell, S., Berkhout, F., Tuinstra, W., Tabara, J. D., Jager, J., Chabay, I., & Otto, I. M. (2013). Opening up knowledge systems for better responses to global environmental change. *Environmental Science & Policy*, 28, 60–70.
- Djenontin, I. N. S., & Meadow, A. M. (2018). The art of co-production of knowledge in environmental sciences and management: lessons from international practice. *Environmental Management*, 61(6), 885–903.
- Espinosa Torres, I. J., & Pons Bonals, L. (2015). La investigación narrativa en educación: Ética, política y cambio educativo. *XIII Congreso Nacional de Investigación Educativa*, 1–11.
- Falk-Krzesinski, H. J., Börner, K., Contractor, N., Fiore, S. M., Hall, K. L., Keyton, J., Spring, B., Stokols, D., Trochim, W., & Uzzi, B. (2010). Advancing the science of team science. *Clinical and Translational Sciences*, 3, 263–266.
- Fernandez-Gimenez, M. E., Ballard, H. L., & Sturtevant, V. E. (2008). Adaptive management and social learning in collaborative and community-based monitoring: A study of five community-based forestry organizations in the western USA. *Ecology and Society*, 13(2), 4.
- Fiore, S. M. (2008). Interdisciplinarity as teamwork: How the science of teams can inform team science. *Small Group Research*, 39(3), 251–277.
- Fiore, S. M., Phillips, E., & Sellers, B. (2014). A transdisciplinary perspective on hedonic sustainability. *Ergonomics in Design*, 22(2), 22–29.
- Gerlak, A. K. & Heikkila, T. (2011). Building a theory of learning in collaboratives: Evidence from the Everglades Restoration Program. *Journal of Public Administration Research and Theory*, 21(4), 619–644.
- Hadorn, H. G., Pohl, C., & Bammer, G. (2010). Solving problems through transdisciplinary research. In R. Frodeman (ed.), *The Oxford Handbook of Interdisciplinarity* (pp. 431–452). Oxford University Press.
- Halevi, G. (2012). Scientific evaluation and metrics – an interview with Julia Lane. *Research Trends*, 27, 15–16. Retrieved from <https://www.research-trends.com/issue-27-march-2012/scientific-evaluation-and-metrics-an-interview-with-julia-lane/>
- Hall, K., Stokols, D., Stipelman, B. A., Vogel, A. L., Feng, A., Masimore, B., Morgan, G., Moser, R. P., Marcus, S. E., & Berrigan, D. (2012). Assessing the value of team science: A study comparing center- and investigator-initiated grants. *American Journal of Preventive Medicine*, 42(2), 157–163.
- Hall, T. E., & O'Rourke, M. (2014). Responding to communication challenges in transdisciplinary sustainability science. In K. Huuoniemi, & P. Tapio (eds), *Transdisciplinary Sustainability Studies* (pp. 135–155). Routledge.
- Herrero, P., Deduerwaedere, T., & Osinski, A. (2018). Design features for social learning in transformative transdisciplinary research. *Sustainability Science*, 1–19.
- Inter-American Institute for Global Change Research (2017). Retrieved from <http://www.iai.int/transdisciplinary-approaches-to-integrating-policy-and-science-canada/?p=24364&lang=en>
- International Science Council (2017). ICSU Annual Report 2017. Retrieved from <https://council.science/publications/annual-report-2017>
- Klein, J. T. (2014). Discourses of transdisciplinarity: Looking back to the future. *Futures*, 63, 68–74.
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., & Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science*, 7, 25–43.
- Mausser, W., Klepper, G., Rice, M., Schmalzbauer, B. S., Hackmann, H., Leemans, R., & Moore, H. (2013). Transdisciplinary global change research: the co-creation of knowledge for sustainability. *Current Opinion in Environmental Sustainability*, 5(3–4), 420–431.
- National Research Council (2014). *Convergence: Facilitating Transdisciplinary Integration of Life Sciences, Physical Sciences, Engineering, and Beyond*. The National Academies Press.
- National Research Council (2015). *Enhancing the Effectiveness of Team Science*. N. J. Cooke, & M. L. Hilton (eds). The National Academies Press.
- Norris, P. E., O'Rourke, M., Mayer, A. S. & Halvorsen, K. (2016). Managing the wicked problem of transdisciplinary team formation in socio-ecological systems. *Landscape and Urban Planning*, 154, 115–122.
- Parker, S., Racz, M. M., & Palmer, P. W. (2018). Decentering the learner through alternative organizations. In *Academy of Management Proceedings*, Vol. 2018, No. 1 (p. 16086). Briarcliff Manor, NY: Academy of Management.
- Pischke, E. C., Eastmond, A. & Alonso-Yanez, G. (2019a). Crossing boundaries: Cross-national research questions and teamwork. In K. E. Halvorsen, C. Schelly, R. Handler, E. C. Pischke, & J. E. Knowlton (eds), *A Research Agenda for Environmental Management*. Elgar Press (In Press).
- Pischke, E. C., Halvorsen, K. E., Mwampamba, T. H., House-Peters, L., Eastmond, A., Ohira, M., Pérez Volkow, L., & Fragoso Medina, M. L. (2019b). Transdisciplinary research teams: Broadening the scope for who participates in research. In K. E. Halvorsen, C. Schelly, R. Handler, E. C. Pischke, & J. E. Knowlton (eds), *A Research Agenda for Environmental Management*. Elgar Press (In Press).

- Pischke, E. C., Knowlton, J. L., Phifer, C. C., Gutierrez Lopez, J., Propato, T. S., Eastmond, A., Martins de Souza, T., Kuhlberg, M., Picasso Risso, V., Vernon, S. R., Garcia, C., Chiappe, M., & Halvorsen, K. E. (2017). Barriers and solutions to conducting large, interdisciplinary research projects. *Environmental Management* 60(6), 1011–1021.
- Podesta, G. P., Natenzon, C. E., Hidalgo, C., & Ruiz Toranzo, F. (2013). Interdisciplinary production of knowledge with participation of stakeholders: A case study of a collaborative project on climate variability, human decisions and agricultural ecosystems in the Argentine Pampas. *Environmental Science & Policy*, 26, 40–48.
- Pohl, C., & Hadorn, H. (2008). Methodological challenges of transdisciplinary research. *Natures Sciences Sociétés*, 16(2), 111–121.
- Polk, M. (2014). Achieving the promise of transdisciplinarity: A critical exploration of the relationship between transdisciplinary research and societal problem solving. *Sustainability Science*, 9(4), 439–451.
- Pregernig, M. (2006). Transdisciplinarity viewed from afar: Science-policy assessments as forums for the creation of transdisciplinary knowledge. *Science and Public Policy*, 33(6), 445–455.
- Ramadier, T. (2004). Transdisciplinarity and its challenges: The case of urban studies. *Futures*, 36(4), 423–439.
- Rikakis, T. (2009). Innovative faculty evaluation criteria for incentivizing high-impact interdisciplinary collaboration. 39th IEEE Frontiers in Education Conference. Retrieved from <https://ieeexplore.ieee.org/document/5350751>
- Schnapp, L. M. (2012). How to talk to strangers: Facilitating knowledge sharing within translational health teams with the Toolbox dialogue method. *Translational Behavioral Medicine*, 1, 1869–6716.
- Steelman, T., Nichols, E. G., James, A., Bradford, L., Ebersöhn, L., Scherman, V., Omidire, F., Bunn, D. N., Twine, W., & McHale, M. R. (2015). Practicing the science of sustainability: The challenges of transdisciplinarity in a developing world context. *Sustainability Science*, 10(4), 581–599.
- Stokols, D. (2006). Toward a science of transdisciplinary action research. *American Journal of Community Psychology*, 38(1–2), 63–77.
- Stokols, D., Misra, S., Moser, R. P., Hall, K. L., & Taylor, B. K. (2008). The ecology of team science: understanding contextual influences on transdisciplinary collaboration. *American Journal of Preventive Medicine*, 35(2), S96–S115.
- Tejedor, G., Segalàs, J., & Rosas-Casals, M. (2018). Transdisciplinarity in higher education for sustainability: How discourses are approached in engineering education. *Journal of Cleaner Production*, 175, 29–37.
- Toikka, K., Miettinen, R., & Tuunainen, J. (2016). Four concepts of network: From connectedness to object-oriented collaboration. *Nordic Journal of Business*, 65(2), 4–23.
- Wenger, E. (2000). Communities of practice and social learning systems. *Organization*, 7(2), 225–246.
- Wuchty, S., Jones, B. F., & Uzzi, B. (2007). The increasing dominance of teams in production of knowledge. *Science*, 316, 1036–1038.