



Building the adaptive capacity of institutions towards managing climate security

A social learning approach

12/2022

Berlin, Germany

Leonardo Medina

Frans Schapendonk

Giulia Caroli

Grazia Pacillo

Jon Hellin

Peter Laderach

Michelle Bonatti



INITIATIVE ON

Climate Resilience

Abstract

The complex nature of climate-related security risks is widely recognized as embodying a collective action problem, thereby requiring a diverse set of actors to mitigate such risks. However, the exact makeup of actor coalitions and the mechanisms to integrate multi-sectoral approaches in programming solutions remain something to be explored under distinct governance systems. This article presents a practical methodological approach to overcome these challenges building upon social learning theory, to foster institutional innovation towards governance systems that are more responsive to climate-related security risks. Social learning is proposed as a governance mechanism to develop multi-stakeholder communities of practice that facilitate climate security-sensitive policies, strategies, and programmes. Outputs from an applied reflexive dialogue evidenced how such a coalition of actors can strengthen capacities to develop locally-owned and adaptive climate action interventions that consciously work to mitigate climate-related security risks.

Introduction

Awareness of the complex and often indirect connections between climate, insecurity, and conflict has been increasingly gaining traction amongst a variety of international and multilateral actors. Dissemination of climate security discourses across the highest circles of policymaking and governance is a notable step forward. A perennial problem, however, remains in the challenge of translating rhetoric into effective policy and programming that address the needs and aspirations of those most affected (Bremberg et al., 2022). Programming solutions that work at the level, scale and mode required by the particularities of affected communities has proven – as ever – a complex task (Abrahams, 2019). Difficulties in designing and implementing responses that explicitly integrate resilience building with efforts to sustain peace, include 1) the coordination between actors operating across different sectors, mandates, mental models and timescales; 2) accounting for complex and unpredictable environments that undermine the design of clear theories of change and make it difficult to evaluate the distinct impacts of interventions; 3) and the fact that adaptive programming for resilience (Sharma-Wallace et al., 2018) and peacebuilding (de Coning, 2018) is often lacking when dealing with complex social-ecological systems.

Given how climate-related security risks tend to be the product of a multi-dimensional set of compounding local, national, regional, and global factors, it is crucial for integrated solutions to be responsive towards the local particularities that contribute to this complex climate-conflict risk landscape. Policy and programme design, along with implementation and evaluation, should thus be informed by a

combination of qualitative and quantitative, locally-relevant, and multifaceted data sources –including factors such as food security, demographics, population movements, natural resources, inter-communal dynamics, political systems, etc.– and involve stakeholders from across the various scales of governance.

Moving from these broad stipulations of effective practice towards operationalising them, however, forms a lacuna in the field of climate security. It is widely accepted that the complex nature of climate-related security risks embodies a collective action problem, and that a diverse set of actors will be required to mitigate such risks (Leonardsson et al., 2021). Despite this, the exact makeup of actor coalitions is often unknown and the mechanisms whereby a productive integration of multi-sectoral approaches to programming could become institutionalised remain something to be explored under distinct governance systems (Busby, 2022). Key questions to answer for those wanting to help build national and sub-national capacities for the purposes of mitigating climate-related security risks include:

- What is the best way to construct, institutionalise, and nurture a diverse coalition of multi-sectoral stakeholders for the purposes of mitigating complex climate-related security risks?
- What processes and logics could be deployed for such a diverse set of actors to reach consensus and common understanding regarding the nature, boundaries, and scale of a ‘wicked’ problem such as climate security?
- How can engagement processes be tailored to foster the continuous learning of actors, networks and institutions towards the progressively more effective management of climate-related security risks?

In response to these challenges, we propose here that social learning theory and practice – particularly those traditions related to situational learning (Wenger, 2010) and systems innovation theory (Beers et al., 2016) – can make an important contribution to enable, guide, and embed the kind of institutional innovation required from governance systems to be more responsive to the emergence of climate-related security risks. This article presents a method, guided by social learning theory, for multi-stakeholder dialogue to support the emergence of networks that learn to “act in more synergistic manners, and thus effectively become a system” (van Mierlo et al., 2010:320), capable of accounting for climate-related security risks within governance systems for resilience and peacebuilding.

Climate security and social learning

Social learning can be broadly defined as a process of knowledge sharing and knowledge co-creation between diverse people around a shared purpose. This process perceives learning and behavioural change as main drivers of transformation, accounting from the individual to networks and systems (Bonatti et al., 2022; Kristjanson et al., 2014). The concept is grounded in the idea that human behaviour emerges as a result of continuous reciprocal interaction between cognitive, behavioural, and environmental influences, and that one's reality is constructed on the basis of feedback and response between external influences and one's own cognitions (Bandura, 1986). This implies that learning goes beyond just an individual cognitive experience, and that content or information cannot be separated from the context of the social exchange in which it is conveyed. Knowledge is instead co-created by actors in a reciprocal process of interaction, exchange, and negotiation with one another and one's environment. Lave and Wenger (1991), for example, in their theory of situational learning, define learning as social participation occurring within a specific social and physical context, in which actors become active participants in a specific community of practice and construct shared identities within said communities. By engaging with one another in deliberation and reflection, different perspectives are likely to adapt and eventually coalesce into a set of shared or complementary understandings.

However, interactive processes do not in themselves ensure that the conditions for innovation, particularly when drastic changes in socio-technological systems are the end goal, will emerge (Crozier and Friedberg, 1990). Iterative cycles of practice and reflection around underlying assumptions, endorsed values, one's own agency and capacity to influence a system, and the challenges of institutionalised practices, are all required to foster transformative change throughout governance systems (Van Epp and Garside, 2014). The principles of social learning therefore offer a way whereby – through an iterative process of social exchange, practice and reflection – transformations in norms, behaviours, and understandings can occur both at the level of the individual actor and at the level of the network in which they are active. These changes can furthermore become embedded in formal and informal norms that dictate decision-making processes, hence becoming institutionalized. This makes social learning theory particularly adept for adaptive management of complex or 'wicked' problems, where there may be no clear or perhaps conflicting knowledge available about the situation (O'Brien et al., 2010), and for which cognitive and relational shifts may be necessary in order to fully conceptualise and effectively plan interventions.

Social learning processes have a technical functionality in the form of an improved understanding of the topic at hand, the pursual of more responsive outputs and impacts, and building adaptive capacity for increasingly complex and uncertain socio-ecological systems and risks (Armitage et al., 2008); a relational functionality in that learning increases the capacity of stakeholders to collectively manage a problem or achieve a set of objectives (Scholz & Methner, 2020); and a transformational functionality by deploying processes of critical reflection over the underlying assumptions and values that ultimately give shape to institutional practices (Pahl-Wostl et al., 2008). Key features of a successful social learning process include the convergence of goals, criteria, and knowledge as a consequence of collective interactions, leading to more accurate and mutually shared expectations; the building of trust and respect between actors; the co-creation of knowledge needed to understand the nature and boundaries of a problem situation; and a change in behaviours, norms, and procedures arising from the mutual understanding of required solutions (Blackmore, 2007).

Building upon this multi-dimensional understanding of social learning processes, it is argued here that the concept is inherently relevant for building the capacity of policy-makers and practitioners at the climate-security-development nexus. The exact causes, consequences, and scope of climate-related security risks, as manifested in specific local contexts, are often poorly understood. Different actors are likely to bring a particular understanding of how climate-related impacts are affecting the context in question, requiring them to partake in a collaborative process of negotiation and adaptation to appropriately define and map these risks. Doing so will thus allow actors to continuously enhance their shared understanding of the climate-conflict interface and better account for its complexity, which can also facilitate the development of a common problem definition - a key baseline condition required for innovation to take place (Sartas et al., 2020). Furthermore, transforming the capacity of diverse actors and networks to better operate as a community of practice through "language-in-interaction" (Dewulf and Bouwen, 2012:170), also creates opportunities to engage in adaptive management and programming, an arguably crucial approach when dealing with non-linear climate and security interfaces.

Conceptualizing climate security through social learning: an applied methodological approach

Social learning theory offers an important set of logics and practices through which coordinated multi-sectoral action on climate security can occur. The presence of these practices alone, however, is not sufficient for ensuring that such logics are effectively embedded in systems of governance. This also requires creating appropriate institutional structures that foster collaborative reflection and action, and

to situate these across social-ecological systems through which social learning can emerge as an instrument for innovation.

Climate Security Workshops in Kenya and Senegal (in Nairobi in June and Dakar in October 2022, respectively) were held as a first attempt towards institutionalising a community of practice, as built upon a social learning foundation, around climate security in both countries. Over 90 stakeholders from the climate, peacebuilding, development and humanitarian sectors in Kenya and Senegal engaged in collective reflection around three goals: 1) explore the potential interconnections between climate hazards and drivers of conflict; 2) identify the multiple ways in which actors intervene in the links between climate and security, along with existing spaces for stakeholder engagement that could serve to foster concerted action on climate-related security risks; and 3) co-develop short-term action strategies towards fostering a climate security agenda and community of practice in Kenya and Senegal. Participants were identified through a snowball approach whereby key informant actors in policy and practitioner circles advised workshop organisers in regard to ongoing climate security-related efforts.

System level instruments used to foster learning at a network level often imply the deployment of spaces for reflective dialogue, agreement on shared visions, and the revaluation of individual and collective roles in bringing about sustainability (Smits and Kuhlmann, 2004). With this aim, the workshop sessions and tools were consciously designed through social learning principles in that they accounted for multiple dimensions of learning, along with different social levels at which learning occurs, in looking to increase collaboration towards managing climate-related security risks. See Medina et al. (2022a) and Medina et al. (2022b), respectively, for further details on the workshop's outputs and methodology as applied in Kenya.

Each of the three goals was operationalized through a half-day participatory session designed with different levels of learning in mind. Session plans were advised by the framework proposed by van Mierlo et al., (2010) to scale system-level innovation and sustainability transitions through social learning (Table 1). Areas of learning in the framework include changes in cognitive, aspirational, relational and action dimensions, while social levels account for individual actors and networks. Changes in stakeholder actions were not accounted for throughout the method, given the difficulties of evaluating changing behaviours through a single engagement space. Instead, intentions for future action were assessed as a proxy.

The use of single- and double-loop learning are designed to expand a narrow vision of learning, understood solely as the acquiring of new technical knowledge (Pahl-Wostl, 2009). Single-loop learning occurs through incremental refinements of established practices to enhance organisational performance, hence increasing actors' technical capacity to understand and manage complexity. Double-loop learning refers to changes in frames of references through deliberative reflection around aspirations, values and assumptions, hence opening pathways for alternative institutional arrangements and practices. Perception of own role and that of others accounts for each actor's sense of responsibility towards addressing a shared problem, and their belief over the network's capacity to do so effectively. Ultimately, social learning takes place when all learning areas lead to modified frames of reference that facilitate more concerted and adaptive action.

Learning area/Social level	Actor	Network
Single loop – aspirations and knowledge	Changes in problem definitions and perceived solutions regarding pre-existing goals.	Common vision on problem definitions and perceived solutions regarding pre-existing goals.
Double loop – aspirations and knowledge	Changes in goals, values, norms or perceived interests, going along with radically new problem definitions and search directions.	Agreement on a desirable future image based on changed goals, values, norms or perceived interests.
Perception of own role and that of others	Increase in feelings of involvement, urgency and responsibility. Enhanced belief in own competencies and freedom of manoeuvre.	Collective engagement and responsibility in the network. Mutual feelings of dependence. Trust in the efforts, competencies and capacities of members in the network.
Actions and behaviour	Changes in behavioural patterns of individuals or internal organisational adaptations.	Increased coordinated or collective action.

Table 1. Areas and levels of learning in the social learning for systems innovation framework. Extracted from (van Mierlo et al., 2010: 324).

The workshop first facilitated an open-ended exploration around direct and indirect linkages between climate effects and risks of social instability in each country. Causal loop diagrams (CLD), a system dynamic modelling tool (Ford, 2000), were created through a participatory approach to capture the non-linear feedback relations between climatic variability, vulnerability, fragility, and insecurity, as perceived by practitioners in their context of work (Medina et al., 2022a: 11). In a second phase, stakeholders used the causal loop diagrams to jointly explored the multiple ways in which their organisations intervene in the climate security interface. This session intended to foster a reflection around the positive and negative security-related feedbacks potentially triggered by organisational interventions. Furthermore, mapping the presence of actors in the system incentivised a discussion around opportunities for collaboration. As part of this activity, participants were asked to identify existing multi-stakeholder platforms which could serve as nodes to foster a climate security agenda within their country (Medina et al., 2022b: 31).

For the last workshop phase, participants built upon the knowledge generated during the previous two sessions in exploring a shared vision of a climate security agenda for Kenya. They jointly developed a set of short-term action strategies towards developing a community of practices for climate security; one which effectively integrates all relevant policy sectors, including climate adaptation, rural development, security and peacebuilding. Relevant dimensions of action were first proposed, including the development of evidence, policy advocacy and development of policy frameworks, integrating climate security in programmatic practices, and finance for climate security. Participants then proposed action strategies, in relation to their area of expertise, to pursue as part of a community of practice, which were finally assessed collectively to agree upon a set of future actions (Medina et al., 2022a: 23).

Evaluating the method

The tools adopted during the workshop emphasised transformative learning as proposed by systems innovation theory, hence seeking to develop shared visions of climate-related security risks among relevant Kenyan stakeholders, and creating suitable opportunities for collaborative action. Dialectical and reflective approaches that are explicitly situated in place-based analysis, as proposed by social learning theory (Ison & Blackmore, 2014), were proposed here as a main route towards system-level change. The workshop included a survey assessing participants' perceptions around the effectiveness and suitability of the exercise (Fig. 2). Evaluating questions were framed to represent the learning areas proposed in Table 1.

Through the first session, participants reflected upon the complex interlinkages between climate and human security. Based on this discussion, a shared vision of system dynamics was developed and agreed upon by all stakeholders after a subsequent round of deliberation (see Fig. 1 for an example output). As shown by the proposed "pathways" of climate-related security risks (Medina et al., 2022a: 11), this session triggered learning as a change in the cognitive understanding of climate-related security risks (actor level) and develop a common vision of climate security dynamics (network level), hence fostering single-loop learning.

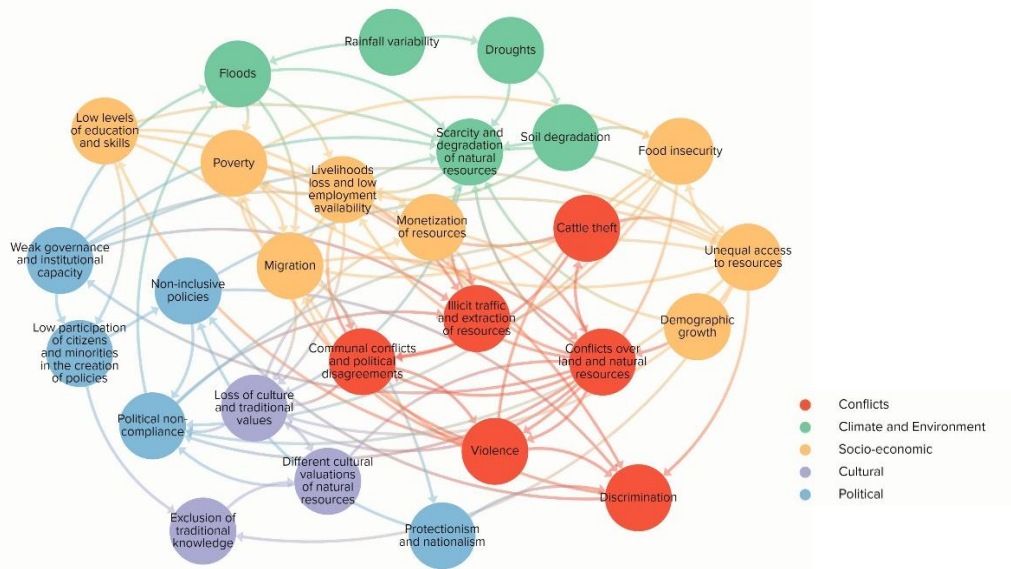


Figure 1. Causal loop diagram of the interlinkages between climate change and security as developed by workshop participants in Senegal.

By situating organisational strategies within a system dynamic model, stakeholders were able to identify potential points for collaborative action and multi-stakeholder spaces whereby effective programmatic planning could take place. They also determined the main opportunities and challenges around fostering the adaptive capacity of each prioritized platform to integrate climate security as an area of concern and programmatic action (Medina et al., 2022b: 36). Through this critical reflection on existing engagement practices for resilience- and peace-building, the method incentivised learning as a change in perceptions around the scope of influence and competencies that each individual actor has over climate security drivers (perception of own role); and it developed a mutual feeling of responsibility, trust and collective capacities for mitigating climate-related security risks (perceptions on others' role).

The last session focused on short-term strategies to foster climate security as a topic of concern within relevant policy sectors. Ultimately, the outputs of this session (Medina et al., 2022a: 23) evidenced a committed involvement in collective efforts towards integrating climate security into existing policy and programmatic practices within the climate and security sectors. In Kenya and Senegal, respectively, workshop participants identified the Climate Smart Agriculture Multi-Stakeholder Platform (CSA-MSP) and the National Committee on Climate Change (COMNACC) as institutional spaces in which a climate security community of practice could become embedded. Furthermore, this session also fostered the development of normative and aspirational intentions (Fig. 2) to consciously account for climate-related

security risks in resilience building practices (second-degree learning), along with an intention and willingness to collaborate with each other while doing so (intended behaviour).



Figure 2. Participants’ evaluation of the method. The results average surveys conducted in Kenya and Senegal.

Conclusion

We outline the barriers that systems of governance currently face with regards to mitigating climate-related security risks, and propose a practical methodological approach to overcome these challenges. Due to its inherent complexity, the climate-conflict interface represents a ‘wicked’ policy problem that requires a set of coordinated and coherent responses enacted across a variety of sectors and scales, and involving a diverse set of actors. We have theorized and tested that social learning theory and practice offer an actionable approach to building and binding appropriate coalitions of action for the purposes of better managing climate-related security risks. In this sense, we have developed preliminary evidence showing that networks that evolve into being through social learning processes may simultaneously help to instil critical governance capacities related to institutional adaptive capacity.

A practical social learning approach as applied here offered a way to reflect upon the design and implementation of the appropriate governance infrastructures capable of facilitating climate security-sensitive policies, strategies, and programmes. These workshops represent a first step towards building these capacities and institutionalising a community of practice as built upon a social learning foundation. As future efforts, a continuous process of reflexion among participating stakeholders should be

encouraged and facilitated by the identified institutions which could potentially further develop a climate security agenda in each country. By fostering regular, iterative cycles of learning, action, and reflexion through the interrogation of beliefs and assumptions on the basis of feedback, social learning processes can also enable actors to challenge institutionalized practices (Pahl-Wostl et al., 2013). Establishing long-term communities of practice can be a critical component in enabling innovative practices to develop effective ways of making climate action a conscious instrument of peace.

With regards to the specific national and institutional contexts covered in this article, there are several concrete ways in which the potential of social learning can be harnessed for embedding climate security-related capacities and knowledge within governance systems. Firstly, the composition of a community of practice focusing on climate security must be diverse in nature, including climate actors (adaptation, mitigation, disaster risk reduction), development actors, and peace and security actors from across scales of governance. This is to ensure perceptions of risk are diverse and an inclusive understandings of climate security can coalesce. The mandate of such bodies should, secondly, be multifaceted, action oriented, and adaptive by design. Their responsibilities could include improving cross-sectoral and cross-scalar coordination on matters relating to climate, development, peace, and security. Equally important, their work should be tailored towards integrating climate-related security risks in policies and programmes in a manner that can ultimately be moulded by iterative processes of reflection over which action strategies evidence best practices and scalable impact.

Acknowledgement

This work was carried out with support from the CGIAR Initiative on Climate Resilience, ClimBeR. We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund.

References

- Abrahams, D. (2019). From discourse to policy: US policy communities' perceptions of and approaches to climate change and security. *Conflict, Security & Development*, 19(4), 323–345.
<https://doi.org/10.1080/14678802.2019.1637080>
- Armitage, D., Marschke, M., & Plummer, R. (2008). Adaptive co-management and the paradox of learning. *Global Environmental Change*, 18(1), 86–98.
<https://doi.org/10.1016/j.gloenvcha.2007.07.002>
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

- Beers, P. J., Mierlo, B. van, & Hoes, A.-C. (2016). Toward an Integrative Perspective on Social Learning in System Innovation Initiatives. *Ecology and Society*, 21(1), art33. <https://doi.org/10.5751/ES-08148-210133>
- Blackmore, C. (2007). What kinds of knowledge, knowing and learning are required for addressing resource dilemmas?: A theoretical overview. *Environmental Science & Policy*, 10(6), 512–525. <https://doi.org/10.1016/j.envsci.2007.02.007>
- Bonatti, M., Erismann, C., Askhabalieva, A., Borba, J., Pope, K., Reynaldo, R., Eufemia, L., Turetta, A. P., & Sieber, S. (2022). Social learning as an underlying mechanism for sustainability in neglected communities: The Brazilian case of the Bucket Revolution project. *Environment, Development and Sustainability*. <https://doi.org/10.1007/s10668-022-02167-z>
- Bremberg, N., Mobjörk, M., & Krampe, F. (2022). Global Responses to Climate Security: Discourses, Institutions and Actions. *Journal of Peacebuilding & Development*, 17(3), 341–356. <https://doi.org/10.1177/15423166221128180>
- Busby, J. W. (2022). *States and Nature: The Effects of Climate Change on Security* (1st ed.). Cambridge University Press. <https://doi.org/10.1017/9781108957922>
- Crozier, M., & Friedberg, E. (1990). *El actor y el sistema: Las restricciones de la acción colectiva* (1st ed.). Alianza.
- de Coning, C. (2018). Adaptive peacebuilding. *International Affairs*, 94(2), 301–317. <https://doi.org/10.1093/ia/iix251>
- Dewulf, A., & Bouwen, R. (2012). Issue Framing in Conversations for Change: Discursive Interaction Strategies for “Doing Differences”. *The Journal of Applied Behavioral Science*, 48(2), 168–193. <https://doi.org/10.1177/0021886312438858>
- Ford, A. (2000). Modeling the Environment: An Introduction to System Dynamics Modeling of Environmental Systems. *International Journal of Sustainability in Higher Education*, 1(1). <https://doi.org/10.1108/ijshe.2000.24901aae.002>
- Ison, R., & Blackmore, C. (2014). Designing and Developing a Reflexive Learning System for Managing Systemic Change. *Systems*, 2(2), 119–136. <https://doi.org/10.3390/systems2020119>
- Kristjanson, P., Harvey, B., Van Epp, M., & Thornton, P. K. (2014). Social learning and sustainable development. *Nature Climate Change*, 4(1), 5–7. <https://doi.org/10.1038/nclimate2080>
- Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation* (1st ed.). Cambridge University Press. <https://doi.org/10.1017/CBO9780511815355>
- Leonardsson, H., Kronsell, A., Andersson, E., Burman, A., Blanes, R., Da Costa, K., Hasselskog, M., Stepanova, O., & Öjendal, J. (2021). Achieving peaceful climate change adaptation through transformative governance. *World Development*, 147, 105656. <https://doi.org/10.1016/j.worlddev.2021.105656>
- Medina, L., Belli, A., Caroli, G., DuttaGupta, T., Tarusarira, J., Schapendonk, F., Savelli, A., Wamu-koya, G., Sokello, Angoma S., Ogallo, L., Nying’uro, P., Kinuthia, M., Onchiri, Anyieni A., Omware, S.,

- Ambani, M., Kithinji, D., Hellin, J.J., Loboguerrero, Rodriguez A.M., Laderach, P. and Pacillo, G. 2022a. Towards a Common Vision of Climate Security in Kenya. Rome, Italy: CGIAR Focus Climate Security. Extracted from: <https://cgspace.cgiar.org/handle/10568/125809>
- Medina, L., Belli, A., Caroli, G., Dutta Gupta, T. 2022b. Towards a Common Vision of Climate Security in Kenya: Workshop Report. Nairobi, Kenya: CGIAR Focus Climate Security. Extracted from: <https://cgspace.cgiar.org/handle/10568/126007>
- O'Brien, G., O'Keefe, P., Gadema, Z., & Swords, J. (2010). Approaching disaster management through social learning. *Disaster Prevention and Management: An International Journal*, 19(4), 498–508. <https://doi.org/10.1108/09653561011070402>
- Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, 19(3), 354–365. <https://doi.org/10.1016/j.gloenvcha.2009.06.001>
- Pahl-Wostl, C., Becker, G., Knieper, C., & Sendzimir, J. (2013). How Multilevel Societal Learning Processes Facilitate Transformative Change: A Comparative Case Study Analysis on Flood Management. *Ecology and Society*, 18(4), art58. <https://doi.org/10.5751/ES-05779-180458>
- Pahl-Wostl, C., Tàbara, D., Bouwen, R., Craps, M., Dewulf, A., Mostert, E., Ridder, D., & Taillieu, T. (2008). The importance of social learning and culture for sustainable water management. *Ecological Economics*, 64(3), 484–495. <https://doi.org/10.1016/j.ecolecon.2007.08.007>
- Sartas, M., Schut, M., Proietti, C., Thiele, G., & Leeuwis, C. (2020). Scaling Readiness: Science and practice of an approach to enhance impact of research for development. *Agricultural Systems*, 183, 102874. <https://doi.org/10.1016/j.agsy.2020.102874>
- Scholz, G., & Methner, N. (2020). A social learning and transition perspective on a climate change project in South Africa. *Environmental Innovation and Societal Transitions*, 34, 322–335. <https://doi.org/10.1016/j.eist.2019.10.011>
- Sharma-Wallace, L., Velarde, S. J., & Wreford, A. (2018). Adaptive governance good practice: Show me the evidence! *Journal of Environmental Management*, 222, 174–184. <https://doi.org/10.1016/j.jenvman.2018.05.067>
- Van Epp, M., & Garside, B. (2014). *Monitoring and Evaluating Social Learning: A Framework for Cross-Initiative Application* (CCAFS Working Paper no. 98). CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). <https://hdl.handle.net/10568/53096>
- van Mierlo, B., Leeuwis, C., Smits, R., & Woolthuis, R. K. (2010). Learning towards system innovation: Evaluating a systemic instrument. *Technological Forecasting and Social Change*, 77(2), 318–334. <https://doi.org/10.1016/j.techfore.2009.08.004>
- Wenger, E. (2010). Communities of Practice and Social Learning Systems: The Career of a Concept. In C. Blackmore (Ed.), *Social Learning Systems and Communities of Practice* (pp. 179–198). Springer London. https://doi.org/10.1007/978-1-84996-133-2_11