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ABSTRACT
Despite a long-term focus on learning in natural resource management (NRM), it is still debated how learning supports sustainable real-world NRM practices. We offer a qualitative in-depth synthesis of selected scientific empirical literature (N = 53), which explores factors affecting action-oriented learning. We inductively identify eight key process-based and contextual factors discussed in this literature. Three patterns emerge from our results. First, the literature discusses both facilitated participation and self-organized collaboration as dialogical spaces, which bridge interests and support constructive conflict management. Second, the literature suggests practice-based dialogs as those best able to facilitate action and puts a strong emphasis on experimentation. Finally, not emphasized in existing reviews and syntheses, we found multiple evidence about certain contextual factors affecting learning, including social-ecological crises, complexity, and power structures. Our review also points at important knowledge gaps, which can be used to advance the current research agenda about learning and NRM.

INTRODUCTION
Natural resource management (NRM) has shifted away from deterministic, top-down thinking to integrative and participatory approaches, where learning is a key concept guiding research and practice (Schusler, Decker, and Pfeffer 2003; Armitage et al. 2018). Despite long-term attention to learning in NRM, a more precise account of how process characteristics and contextual factors affect learning by NRM users, however, is still lacking. The NRM literature commonly assumes that learning happens through interactive processes, either as part of facilitated participation (e.g., Diduck et al. 2012), or by self-organized collaboration (Armitage, Marschke, and Plummer 2008). For example,
Diduck et al. (2012, 1313), argue that transformative learning occurs through “deliberate interventions in which stakeholders in a complex NRM situation are brought together to engage in an iterative, facilitated process of critical reflection and inquiry aimed at provoking transformational changes in cognition and practice.” However, learning may emerge from self-organized interactions as well, as often described by the adaptive co-management (ACM) literature (e.g., Plummer, Armitage, and de Loë 2013). The context within which learning takes place includes the socio-economic and political setting, the governance arrangements, but also geographical and ecological conditions that vary from case to case (Mostert et al. 2007; Pahl-Wostl 2015). Yet, while how context affects learning has been addressed in individual empirical cases (e.g., Pahl-Wostl 2015), the context has not been subject to more systematic knowledge synthesis methods, i.e. reviewing how context is reported to be affecting learning (e.g., Rodela 2011). An exception to this is the review by Siebenhüner, Rodela, and Ecker (2016) which, for instance, considers formal and informal institutions.

In this study, we aim to fill this gap. We address the following research question: how are the factors (assumed to) support action-oriented learning constructed in the empirical literature? To this end, we draw on one of the most recent reviews undertaken in this field (Suškevičs et al. 2018). We start from their sample ($N = 53$ empirical articles), which we further analyze to find answers to our question. In doing so, first, we intend to provide a synthesis of process-based and contextual factors affecting action-oriented learning as found in the selected literature. We acknowledge that analytical frameworks applied in individual empirical studies take into account the process and context; however, process/context was not subject to thorough assessment in earlier knowledge syntheses (cf. Ensor and Harvey 2015). This we assume might have been due to the limited opportunities some methods of knowledge synthesis offer for the analysis of an evidence base that is often qualitative (e.g., in the NRM research field). Existing literature reviews take a predominantly quantitative approach where quantification and distribution across variables of interest are reported upon (e.g., Siebenhüner, Rodela, and Ecker 2016). While quantitative approaches are useful to survey the breadth of research, they are however limited in analytical depth. We take note of the observations by Hannes and Macaitis (2012) on qualitative syntheses being promising but a poorly used approach in the field of NRM. With this study, we intend to assess the suitability of thematic synthesis, i.e., a method used to analyze and synthesize results from primary qualitative research (Thomas and Harden 2008), for use in the field of NRM. Further, earlier reviews have often focused on mapping the broader discourse and analytical frameworks, while in this study we focus on the empirical evidence as reported in the selected literature. This we believe is appropriate since all of the 53 articles report on qualitative case study methodology. Additionally, earlier reviews have mostly focused on the social learning concept (e.g., Cundill and Rodela 2012; Ensor and Harvey 2015; Siebenhüner, Rodela, and Ecker 2016) but we include further learning concepts, to create a wider basis for understanding the role of learning for NRM action (cf. Gerlak et al. 2017; Suškevičs et al. 2018).

Our approach to the analysis and synthesis is explicitly inductive. We use the next section (background) only as a broad frame to (i) depict the state of the art on different learning concepts currently used in the broader NRM literature, and (ii) summarize
what the literature says about the factors affecting them. Thereafter we describe our method, the thematic synthesis of 53 empirical articles, which have been identified and selected by a recent review (i.e., Suškevičs et al. 2018). After this, we summarize our results: emergent themes of factors affecting action-oriented learning. We then discuss how these themes relate to different sub-groups of NRM literature on learning, such as from the ACM and participatory environmental governance domains. We conclude with recommendations for further research and NRM practice.

**Background**

The NRM literature refers to learning in various ways. To set a general background for our study, we give a brief overview of the main concepts used by some of the most prominent and well-cited literature and summarize key factors, which are found to support learning. We also introduce the concept of action-oriented learning.

**A Brief Overview of the Main Theoretical Approaches to Learning in the NRM Literature**

The construct of “social learning” (Rodela 2011) is probably among the most widely used notions in the NRM literature but is also one of the fuzziest (Muro and Jeffrey 2012). It is used to refer to learning based on individual experiences, with changes often observable at a cognitive, relational and moral level. Social learning is also used to refer to wider social change processes, also sometimes termed “societal learning” (e.g., Reed et al. 2010).

The NRM literature uses other theoretical frameworks as well, as is transformative learning and policy learning. Transformative or transformational learning originates in social psychology (e.g., Mezirow 1991) and the theory initially focused on individual adult learning. Since then, the focus has broadened, e.g., according to Taylor (2008, 10): “transformative learning is as much about social change as individual transformation”. The concept has been widely applied in the literature on ACM and participatory NRM (e.g., Keen and Mahanty 2006; Marschke and Sinclair 2009; Diduck et al. 2012). The literature on ACM has explored transformational learning of individuals and groups, inclusive of potential changes in management practices (e.g., Plummer, Armitage, and de Loë 2013).

Policy learning originates in studies on public policies (e.g., Bennett and Howlett 1992) and it conceptualizes how policy actors (e.g., state officials or policy networks) learn about organizations, programs or policies (Heikkila and Gerlak 2013). This concept has been taken up by the NRM literature more recently (Gerlak et al. 2017). Other concepts are also used, such as “organizational learning” or “experiential learning.” We do not focus on them here, as the theoretical basis of the empirical articles included in this paper (i.e., the sample from Suškevičs et al. 2018) mainly covered the three above-mentioned concepts.

**What Affects Learning? A Critical Reflection on Existing Assumptions**

The literature suggests that various process-based and contextual factors affect learning. Based on current theoretical and empirical publications (Table S1) we summarize below
these assumptions. By “process”, we understand the internal factors to learning, including the actors, facilitators or organizers, and social dynamics occurring in a group. By “context”, we understand attributes that are external to processes, such as characteristics of the issue and decision-making. Note that in this article, we use these the terms “process” and “context” mainly as broad categories (i.e. “realms”) meant to structure the findings found in the empirical literature in our synthesis (section Results).

Process characteristics in existing literature include various types of interactions (e.g., deliberations) among different stakeholders and/or the public, which are moderated by skilled facilitators. The literature sets several normative criteria to these processes, such as the process has to be widely inclusive, promote unrestrained thinking, effective information exchange and support continuous interactions (Mostert et al. 2007; Koontz and Newig 2014; Pahl-Wostl 2015). The literature on ACM often describes cases where learning occurs through self-organizing processes and learning by doing (e.g., Plummer et al. 2012; 2013), in social networks or network governance (e.g., Crona and Parker 2012). A focus on the role of networks in learning is also characteristic of the environmental governance literature (e.g., Koontz and Newig 2014).

Examples of contextual factors not only include organizational and political cultures but also institutions, which are especially evident in the policy learning literature (e.g., Dunlop and Radaelli 2018). Other key contextual factors include resources (e.g., time) available for the actors, and the nature of the topic under question. The latter is emphasized in the ACM literature (e.g., Folke et al. 2005) and in the literature using the social learning construct (e.g., Mostert et al. 2007; Pahl-Wostl 2015).

**Action-Oriented Learning**

Attention has been directed to study the learning process, less to analyze the context within which it takes place. However, researchers have matured interest in approaches, methodologies, and tools with the potential to stir real-world changes (Collins and Ison 2009; Reed et al. 2010; Cundill and Rodela 2012). In this study, we are interested in a specific type of learning that we term “action-oriented learning”. Action-oriented learning refers to not only changes observable at the levels of individuals and groups – learning outcomes (e.g., cognitive or relational advancement) – but also to changes in the NRM domain (e.g., new management practices, policies or institutions) (Suškevičs et al. 2018). While Suškevičs et al. (2018) analyzed outcomes of action-oriented learning; here, we focus on how action-oriented learning occurs.

**Methods**

**Study Design and Literature Sample**

The field of NRM on learning has been subject to several subsequent reviews. Given the relevance to our objectives, we chose to use the sample of 53 papers identified by Suškevičs et al. (2018) over other reviews for the following reasons: (i) this is one of the last systematic attempts to identify and select literature on learning and NRM, (ii) their sample focuses on empirical papers, and (iii) their inclusion and exclusion criteria for
paper selection focus on studies that reported on (successful) outcomes related to learning – a circumstance key to meet our objective to analyze the factors supporting learning.

Suškevičs et al. (2018) undertook a systematic literature search (Figure 1) aimed to map empirical NRM literature discussing learning effects as manifested in NRM. They used: TS (Topic Search) = “social learning” or “experiential learning” or “participatory learning” or “collaborative learning” or “societal learning” or “transformative learning” or “policy learning” and forest* or ecosystem* or ecology* or water or biodiversity or agriculture* or wetland or landscape* or climate or “land use” or restore*. The search was done in the WoS database core collection (citation indexes: SCIE, SSCI, CPCI-Sci, CPCI-SocSci and Hum, ESCI) in November 2015. No time limits were applied.

The final sample includes 53 articles listed under References and Table S2. For further methodological details see Suškevičs et al. (2018).

**Data Analysis: Thematic Synthesis**

**Approach**

Given that all 53 selected articles were qualitative case studies or comparative case studies, we chose to use thematic synthesis, which is a method suitable for in-depth exploration of research questions. Thematic synthesis is a method for knowledge synthesis that extracts data from primary studies through coding and then organizes the extracted data into emerging themes (see: Thomas and Harden 2008, reformulated). Thematic synthesis belongs to the family of qualitative meta-studies, i.e., interpretive translations deriving from the integration and comparison of findings from qualitative studies (Sandelowski et al. 1997, 366). As such, thematic synthesis combines principles from meta-ethnography and grounded theory (see: Zimmer 2006; Hannes and Macaitis 2012).

**Steps**

Our approach to the thematic synthesis is summarized in Figure 2. Thematic synthesis inevitably raises questions about different levels of interpretation (Zimmer 2006). Figure 2 illustrates our “interpretation of the interpretations of primary data by the original authors of the constituent studies” (Zimmer 2006, 312). The data for this paper are the first-order constructs made by the authors of the included articles about the factors affecting action-oriented learning (Data for analysis, Figure 2).

Our synthesis includes two steps. The first step “Data-driven analysis” (Figure 2) is a reciprocal translation of key concepts and themes from one article in another article’s terms (Thomas and Harden 2008), using descriptive coding of line-by-line text passages of the 53 articles. Descriptive coding relies on an open coding principle, where ultimately descriptive themes – second-order constructs by the synthesists – are developed. We organized text sections into eight factors, some of which concerned “process” and some “context”.

The second step “Synthesis” (Figure 2) involves further interpretation of descriptive themes. We systematically compared and contrasted the eight themes (groups of
text sections), based on our research questions. We synthesized key factors supporting and hindering learning into key themes and sometimes sub-themes. These are third-order constructs, i.e., new concepts and understandings. Table 1 summarizes the results of our thematic synthesis.
Table 1. Factors supporting action-oriented learning: results from the thematic synthesis of the 53 selected journal articles.

<table>
<thead>
<tr>
<th>REALM (no. of articles)</th>
<th>Key theme: Decisive FACTOR</th>
<th>No. of articles</th>
<th>SUB-THEMES: Links to action-oriented learning</th>
<th>No. of articles</th>
<th>References to the reviewed articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>I - Process (41 articles)</td>
<td>1. Participatory and collaborative arenas</td>
<td>24</td>
<td>1.1. Facilitated space for dialog</td>
<td>13</td>
<td>Benson, Lorenzoni, and Cook (2016); Hoverman et al. (2011); Huntjens et al. (2011); Lebel, Grothmann, and Siebenhüner (2010); McDougall et al. (2013); Moellenkamp et al. (2010); Pahl-Wostl et al. (2013); Rist et al. (2007); Schneider et al. (2012); Sims and Sinclair (2008); Wallis, Ison, and Samson (2013); Watanabe et al. (2014); Yuen, Jovicich, and Preston (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.2. Self-organizing capacities</td>
<td>9</td>
<td>Armitage et al. (2011); Biedenweg and Monroe (2013); Hahn et al. (2006); Kumler and Lemos (2008); Lee and Krasny (2015); Murillo, Norris, and Biernacki (2015); Olsson, Folke, and Hahn (2004); Tidball et al. (2010); Van Assche et al. (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.3. Conflicts triggering learning</td>
<td>5</td>
<td>Biedenweg and Monroe (2013); d’Angelo and Brunstein (2014); Dana and Nelson (2012); Maynard (2015); Yuen, Jovicich, and Preston (2013)</td>
</tr>
<tr>
<td></td>
<td>2. Proximity to praxis</td>
<td>18</td>
<td>3.1. Intentional experimentation</td>
<td>12</td>
<td>Bos and Brown (2012); Cheng, Danks, and Allred (2011); Cundill (2010); Hahn et al. (2006); Hurlbert (2015); Leys and Vanclay (2011); Moellenkamp et al. (2010); Nguyen, Seddaiu, and Roggero (2014); Olsson, Folke, and Hahn (2004); Pahl-Wostl et al. (2013); Puente-Rodriguez et al. (2015); Van Assche et al. (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.2. Practice-based dialogs and boundary objects</td>
<td>8</td>
<td>Albert et al. (2012); Alkan-Olsson et al. (2011); Cheng, Danks, and Allred (2011); Cundill (2010); Madsen and Noe (2012); Puente-Rodriguez et al. (2015); Sinclair, Kumerdpet, and Moyer (2013); Wise (2014)</td>
</tr>
<tr>
<td></td>
<td>3. Intermediaries</td>
<td>14</td>
<td>2.1. Bridging organizations and individuals</td>
<td>10</td>
<td>Bos and Brown (2012); Cundill (2010); Hahn et al. (2006); Hoverman et al. (2011); Johannessen and Hahn (2013); Leys and Vanclay (2011); Moellenkamp et al. (2010); Nykvist (2014); Olsson et al. (2004); Pahl-Wostl et al. (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2.2. Facilitative leadership</td>
<td>12</td>
<td>Albert et al. (2012); Bos and Brown (2012); Cundill (2010); Hoverman et al. (2011); Hurlbert (2015); Johannessen and Hahn (2013); Leys and Vanclay (2011); Nykvist (2014); Olsson, Folke, and Hahn (2004); Pahl-Wostl et al. (2013); Secco, Pettenella, and Gatto (2011); Sol, Beers, and Wals (2013)</td>
</tr>
<tr>
<td>II - Context (31 articles)</td>
<td>4. Power asymmetries</td>
<td>13</td>
<td>7.1. Balancing power asymmetries</td>
<td>13</td>
<td>Balazs and Lubell (2014); Biedenweg and Monroe (2013); Boyd et al. (2014); Hilden (2011); Hordijk et al. (2014); Hoverman et al. (2011); Leys and Vanclay (2011); McDougall et al. (2013); Shaw and Kristjanson (2014); Sol, Beers, and Wals (2013); Van Assche et al. (2013); Van Gossum et al. (2008); Vinke-de Kruijf, Bressers, and Augustijn (2014)</td>
</tr>
</tbody>
</table>

(continued)
Limitations of the Methodology

Meta-methods, such as thematic synthesis belong to the interpretive research paradigm and involve a certain degree of subjectivity (Hannes and Macaitis 2012). Therefore, working with not well-defined concepts (e.g., social learning) affects the review process. In such cases, we debated emerging themes among coauthors and disagreements were resolved by discussion. The first author primarily did coding; we discussed the wording of final themes among all until we reached agreements about each theme. Additionally, while building themes, we regularly returned to the original articles, to keep our interpretations as close as possible to the meanings in original articles.

Limitations of the Evidence Base

The articles included discuss learning processes and their outcomes, however, what was regarded as an outcome, and what were the processes facilitating it, was occasionally not very clear. For instance, network-building would be considered a factor affecting learning, but also sometimes a learning outcome. This made it challenging for us to distinguish with clarity how the authors of the selected papers have conceptualized the different components, and the assumed relationships between them.
Results

Methodologically, the 53 articles identified as relevant for our analysis report on mostly qualitative case studies: 35 articles on a single case study and 66 articles on comparative case studies. Several papers report on more than one case (in total these made up to 101 cases). Further, 32 articles report on interventions in the form of facilitated processes while 16 papers report on self-organizing, emergent processes.

The analysis of the evidence reported by the 53 papers led to the identification of eight decisive factors or “key themes” in total (Figure 3 and Table 1). Specifically, we identified three themes for the process: (i) participatory and collaborative arenas, (ii) proximity to praxis, and (iii) intermediaries. We identified five themes for context: (i) power asymmetries, (ii) social-ecological crises, (iii) time, (iv) complexity of social-ecological systems (SESs), and (v) identity.

Realm I: Process

Factor 1: Participatory and Collaborative Arenas

Facilitated space for dialog. Thirteen reviewed articles discuss the importance of enabling a space for extended dialog for learning and provide descriptive evidence of how that turned out in their case studies. For instance, as Hoverman et al. (2011) put it: creating “appropriate conditions to facilitate constructive engagements”. This was evident not only in this sub-theme (organized participation) but also in the next sub-theme (self-organized collaboration). Most of the reviewed articles under both sub-themes highlight the importance of co-design of participation, whereby stakeholders can develop co-ownership in these processes.
Self-organizing capacities of networks. Nine articles report on research where self-organizing collaboration was explored and evidence was observed of how learning leads to innovative ideas and collective-action towards sustainability practices. For instance, Van Assche et al. (2013) found that internally defined goals for learning and preexisting networks – rather than artificially created learning environments – have created favorable conditions for a continuous exchange and implementation of innovative ideas in the ice-fishing communities (Canadian Arctic).

Conflicts triggering learning. Five publications in our sample discuss cases where conflictual processes have supported learning. Dana and Nelson (2012, 243) write about “constructive conflicts” when facilitating learning through Environmental Risk Analysis of biodiversity of genetically modified crops (South-Africa). Maynard (2015) reports a similar circumstance (UK), occurring in relation to water management where conflicting expectations were discussed in a competence group, leading to a collaborative solution. Learning in such occasions meant that divergent opinions were recognized first, then debated openly and finally accommodated until the issue was settled.

Factor 2: Proximity to Praxis

Eighteen articles report on learning processes being facilitated in situations where people share a real concern about given problems. We refer to this as “proximity to praxis”.

Intentional experimentation. Twelve articles connect the experimental nature of governance processes to learning and the resultant changes. Three articles support the idea that learning happens through intentional experimentation as it opens up actors’ minds to new ideas. For instance, Bos and Brown (2012) describe a long-term governance experiment in the urban water sector in Australia, where open networks of actors and their willingness to try something new enabled learning.

Practice-based dialogs and boundary objects. Eight articles suggest that boundary objects facilitate discussions on real-world experiences and therefore have the potential to initiate action towards NRM change. Different entities can have a boundary-role. For instance, a conservation agreement discussed by Puente-Rodriguez et al. (2015) served as a boundary object as it brought together different identities associated with fishing traditions, creating a common knowledge base among the actors and leading to certain actions towards sustainable mussel fishery practices (Netherlands).

Factor 3: Intermediaries

Fourteen articles report on the significance of intermediary roles which key individuals and organizations have for facilitating and promoting action-oriented learning.

Bridging individuals and/or organizations. Ten articles discuss examples of the importance of bridging individuals and/or organizations. For instance, Bos and Brown (2012) identify a bridging organization, which promotes sustainable water practices and shared experiences in urban water governance experiment (Australia), and an important role in the case(s) they worked on.
Facilitative and transformational leadership. Twelve articles identify a role for individual leadership and provide evidence of ways it transmits new knowledge in learning processes. For example, this is in the form of key individuals or groups putting forward innovative ideas and act on them. Four papers in our sample discuss that a shared leadership (rather than individual) is needed for more sustainable NRM practices (e.g., Leys and Vanclay 2011; Johannessen and Hahn 2013).

Realm II: Context

Factor 4: Power Asymmetries

We found thirteen articles giving evidence of how power asymmetries between various actors hinder learning. This concerns dominant coalitions (e.g., Van Gossum et al. 2008; Boyd et al. 2014; Balazs and Lubell 2014), or a lack of distributional justice (e.g., Biedenweg and Monroe 2013; Shaw and Kristjanson 2014). For example, differences in commitment and power among policy officers and NGOs created tension and diminished trust within the rural planning network in the Netherlands (Sol, Beers, and Wals 2013). Three articles also discuss possible solutions to address power discrepancies (Leys and Vanclay 2011; McDougall et al. 2013; Van Assche et al. 2013).

Factor 5: Social-Ecological Crises

Eleven articles attribute learning, and the subsequent outcomes, to social-ecological crises. Crises reported most commonly include environmental disturbances (e.g., floods or droughts), but also contested aspects of biodiversity issues (e.g., disputes over fish stock situations). Researchers found that such circumstances had the potential to engender a reassessment of the status quo and subsequent change of the actions.

Factor 6: Time

Eleven articles highlight time as a key factor affecting the achievement of learning outcomes. For example, several articles defend the view that sufficient time should be allocated for preparing the interventions, e.g., workshops (Moellenkamp et al. 2010), and for negotiation (Biedenweg and Monroe 2013). Balazs and Lubell (2014) emphasize that certain long-term effects (e.g., structural changes in water governance institutions) may become visible only over extended time.

Factor 7: Complexity

Six articles point at the oversimplification of complex problems as a factor hindering action-oriented learning. Examples include the simplification of risk, adaptation options and the complexity of socio-technical change (e.g., Puszkin-Chevlin and Esnard 2009; Boyd et al. 2014). Certain authors emphasize misfits between top-down governance and the bottom-up learning approach (e.g., Vinke-de Kruijf, Bressers, and Augustijn 2014), together with difficulties in combining informal learning processes with formal decision-making (e.g., Pahl-Wostl et al. 2013; Van Assche et al. 2013).
**Factor 8: Identity**

Four articles point at the role of *identities* in affecting action-oriented learning. For instance, when shared identity construction in a community does not occur, it can inhibit learning processes. As Boyd et al. (2014, 140) note that social learning for adaptive governance requires attention to “competing understandings of risk and identity,” in the context of urban planning where the informal settlements are currently largely ignored by governmental bodies (Mozambique).

**Discussion**

We need a better understanding of how learning, intended to support changes in real-world NRM occurs and can be triggered (e.g., Reed et al. 2010). With the present study, we attempt to make a step forward in this direction. In the following, we outline core lessons that emerge from our synthesis of the current empirical literature. These lessons, which NRM practitioners and researchers may find useful for their work, concern two broad realms: the learning processes and the contexts.

**Lesson 1: Self-Organizing, As Well As Externally Facilitated Processes, Support Action-Oriented Learning**

This lesson connects different NRM study fields that discuss learning (e.g., ACM, participatory environmental governance), suggesting that self-organizing governance networks for NRM are complementary to and nested in government regimes (Hahn 2011) or other externally facilitated processes. Yet, several authors (e.g., Collins and Ison 2009) note that participation or collaboration should be used as diagnostic tools but not a panacea for strategic planning. Here, a key role is on intermediaries and a concept of shared leadership, which support facilitated as well as emerging group processes. Much of the argument on intermediaries is based on the ACM literature, which discusses “bridging organizations” as an approach to support learning (Folke et al. 2005). A bridging organization is “an arena for trust-building, vertical and horizontal collaboration, learning, sensemaking, identification of common interests, and conflict resolution” (Hahn et al. 2006, 586). Concepts of shared leadership recognize similar ideas, e.g., the notion of “transformational leadership” from the ACM literature (e.g., Olsson, Galaz, and Boonstra 2014) or “facilitative leadership” from the literature on environmental governance (e.g., Ansell and Gash 2007).

**Lesson 2: If Treated Constructively, Social-Ecological Crises May Facilitate Action-Oriented Learning**

This lesson brings together several key findings from our review: namely environmental crises, conflictive processes, and power asymmetries. Our results suggest a distinct link between environmental crises and action-oriented learning if crises are regarded as “windows of opportunities” (Olsson, Folke, and Hahn 2004). This pattern is especially evident in the ACM literature, and also in articles that rely on policy learning theories, which tend to draw direct links between learning and the resultant policy changes.
(Weible et al. 2012). The lesson also suggests that in addition to collaborative processes, conflicts may support learning as well, provided that conflicts are treated constructively – an idea found in earlier studies (mostly from the participatory resource management field, e.g., Schusler et al. 2003; Keen and Mahanty 2006). Yet, some studies from existing ACM literature suggest that learning processes may not always result in common visions (e.g., Olsson, Galaz, and Boonstra 2014). This ultimately relates to how power relations are treated: addressing power asymmetries may support learning. In general, existing reviews of the NRM literature have only rarely examined the role of certain contextual factors, such as power relations in relation to learning. Our synthesis strongly suggests that power asymmetries between actors hinder learning. This lesson mainly derives from the sub-groups of NRM literature on environmental governance (e.g., Olsson, Galaz, and Boonstra 2014) or the ACM scholarship (e.g., Sandström 2009; Crona and Parker 2012).

**Lesson 3: Proximity to Practice Supports Action-Oriented Learning**

Our synthesis suggests that intentional experimentation, as well as reflection through hands-on self-emergent experiences, facilitates action-oriented learning. Experimentation is a central theme in the ACM literature (e.g., Armitage, Marschke, and Plummer 2008) where learning outcomes are meant to inform future policies. Our results further indicate that different kinds of entities can facilitate action-oriented learning. These entities are often termed as “boundary objects”, which relate to bridging organizations, denoting “hybrid constructions” meant to “facilitate the negotiation and exchange of multiple types of knowledge” (White et al. 2010, 221). Boundary objects are often discussed in the ACM scholarship (e.g., Crona and Parker 2012) but also in the literature on collaborative/participatory resource governance (e.g., White et al. 2010).

**Implications for Further NRM Research**

This review has identified two key knowledge gaps in the current empirical literature. These are relevant for both primary research and for research syntheses.

First, despite increasing attention to contextual factors affecting learning, contextual issues are often addressed vaguely in the current empirical NRM literature. This is an important knowledge gap. Given that many assume these aspects can significantly affect the outcomes of learning, more in-depth research is needed to clarify questions around these. For instance, further studies could clarify specific links between time, identity, and action-oriented learning. Several studies, especially from the ACM literature, underline that learning outcomes often require longer time-scales, e.g., years or decades, to become evident (Plummer and Armitage 2007; Armitage, Marschke, and Plummer 2008). Our synthesis highlights that the role of time might be different in cases of organized and self-emerging processes. In the case of intervention-based learning, future studies could benefit from research designs that integrate ex-ante and ex-post assessments. In the case of studies exploring learning outcomes within self-emerging processes, it would be useful to explicate how time frames were accounted for and what analytical criteria were used to reconstruct past events, and their effects. However, methodological aspects are often debated in research on learning (Cundill and...
Rodela 2012) and we did not systematically explore the methods used in the reviewed studies. This is something future syntheses could focus on.

Second, the various sub-groups of NRM literature – i.e., literature which uses different theoretical lenses to study NRM (e.g., ACM or collaborative governance) and also applies different learning concepts (e.g., social learning or policy learning) – could benefit from a tighter exchange. For instance, the ACM literature, with its pragmatic and instrumental approach to learning, has recently but only partly converged to the environmental governance scholarship. At the same time, the problem-based environmental governance literature has brought new topics into the learning discourse. A more dynamic exchange between these bodies of works may help to address some of the key challenges in contemporary environmental governance (Plummer, Armitage, and de Loë 2013), especially in terms of learning outcomes in real-world situations. Our synthesis also suggests that the various sub-groups of NRM literature have many aspects in common and, for instance, they seem to share a position on how action-oriented learning occurs (e.g., the view on self-organized and facilitated participation supporting learning). Future reviews of published literature could systematically compare this and such comparisons could potentially further reveal the specific links between learning and its implications to NRM practice.

Conclusions

Action-oriented learning, as used in the NRM research field, is a concept that focuses on learning outcomes as well as their manifestations in real-world. The present review of published empirical qualitative literature identified eight factors that are reported to have a key effect on action-oriented learning. The sample of papers we surveyed includes only empirical research, which allows to better comprehend how action-oriented learning is suggested to emerge in real-world resource management situations. Our review also points at important knowledge gaps, which can be used to further the current research agenda about learning and NRM.

This study also has sought to test if thematic synthesis – as an analytical method to describe, synthesize, and catalog evidence across the NRM literature – is well suited for the task at hand. We found that thematic synthesis, as a qualitative review technique, allowed us to investigate in a more in-depth way the ongoing discourse on learning. Thematic synthesis proved especially useful for synthesizing evidence from qualitative studies, which often have diverse designs and are not easy to compare by quantitative approaches (see: Hannes and Macaitis 2012). While thematic synthesis allows grasping an in-depth narrative about the evidence base, the method, however, is limited in generating specific management recommendations. Therefore, the lessons we are able to draw from our study represent broad suggestions; their validity depends on the concrete management context.

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Note

* denotes references to the 53 included articles.

References


