



Climate adaptation as a team process: the role of place-based climate adaptation workshops in catalysing collective action

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Place-based climate adaptation workshops are an increasingly common approach to advance collective efforts to cope with the effects of climate change. Despite their increasing prevalence, uncertainty remains about effective and ineffective elements of these processes. We conducted a comparative case study across 30 communities in which workshops took place in the United States between 2017 and 2020 to identify which workshop characteristics were most often associated with subsequent adaptation-related planning and action. We examined these workshops through a team process lens to reveal which inputs, processes, and emergent states distinguished workshops with substantial evidence of positive impact ($n=6$) from those with little impact ($n=6$). Key factors included the involvement of a local champion, co-design of the workshop between facilitators and participants, and sustained engagement post-workshop. As more communities embark on multi-sectoral processes meant to catalyze collective climate action, these findings offer insights for ensuring efforts are as effective as possible.

Keywords: climate change adaptation; workshop; team process; co-design; climate champion; emergent states

1. Introduction

The impacts of climate change are present, pervasive, and predicted to persist and progress (IPCC 2022). In response, individuals and groups are engaging in climate adaptation, or “the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities” (IPCC 2022, 5). One approach being used to advance climate adaptation is place-based climate adaptation workshops, which we define as convenings or series of convenings designed to help multiple stakeholders develop strategies for adapting to climate change in a specific place (Stern *et al.* 2023). Place-based adaptation workshops began to gain prominence in recent years as a response to both perceived inaction around climate change mitigation and to adaptation efforts focused on techno-centric strategies. In contrast, place-based

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adaptation efforts seek to focus at the scale where impacts occur, to value and integrate local knowledge by engaging a broad array of stakeholders, and to embed adaptation within ongoing socio-political processes (McNamara and Buggy 2017). These processes are generally conducted by external facilitators, who are often associated with governmental or non-governmental organizations, and whose subject-matter expertise and experience with facilitation can support local adaptation workshops (Stern *et al.* 2023).

Adaptation workshops may focus on urban systems, natural-resource management, or other focal areas. They can yield a range of learning, planning, and action outcomes that may contribute to adaptation in an area (O'Brien *et al.* 2024). Adaptation efforts, in turn, may reduce vulnerability to climate risks, increase system resilience, and enhance a community's adaptive capacity (Osbaahr *et al.* 2010).

To advance understanding of the ways workshops can contribute to adaptation processes and why some workshops yield stronger outcomes than others, we sought to answer the following research question:

What characteristics of place-based climate adaptation workshops are associated with higher degrees of planning and action after the workshop?

We conceptualize place-based climate adaptation workshops as team processes (Marks, Mathieu, and Zaccaro 2001). Team process theory suggests that groups draw upon a range of inputs that inform the collective processes they undergo, which in turn contribute to emergent states and outcomes. The outcomes in this study are conceptualized as planning and action outcomes that participants directly attributed to the workshop. Our approach sorts the cases in our sample by the nature of these outcomes identified by participants and explores differences in the inputs, processes, and emergent states associated with those workshops featuring stronger or weaker evidence of impact.

2. Literature review

2.1. *Adaptation workshops as team processes*

Contemporary work processes are often organized into teams and accomplished through teamwork, and the successes and failures of collaborative efforts can be explained, in part, by the function of the teams advancing those efforts and the contextual backdrop within which they operate (Marks, Mathieu, and Zaccaro 2001). Place-based climate change adaptation requires concerted and coordinated collaborative efforts by individuals and entities living and working in the places where climate impacts are—or will be—experienced and where adaptive actions can be undertaken. Conceptualizing these groups as teams offers an analytical framework to examine the ways in which they plan for, and take, adaptive actions, which is well suited to the scale and dynamics of place-based adaptation workshops.

Many examinations of climate adaptation focus at the individual or household level, which may fail to account for emergent, interpersonal phenomena (e.g. Van Valkengoed and Steg 2019; Noll *et al.* 2022). Situating our analysis at the level of teams allows for the examination of these collective factors, such as social learning and trust. It also enables an analysis of a wider range of group structures than some alternative group-level frameworks and approaches; and suggests mechanisms by which adaptation may fail or flourish.

For example, the Collective Impact framework (Kania and Kramer 2011), suggests an idealized arrangement of actors and prescriptive action set for collaborative efforts that may not be feasible under the realities faced by groups participating in climate adaptation workshops.

Other approaches advance a heuristic framework for collective adaptation factors contributing collective mobilization and identify potential adaptation outcomes but fail to describe how these factors may interact to drive outcomes (Wannewitz and Garschagen 2023), or examine how networked governance structures afford an opportunity structure for individual engagement in climate adaptation without accounting for how group dynamics play out over time (Tosun and Schoenefeld 2017). The strength of the team process framework lies in its ability to account for the contextual backdrop within which adaptation occurs, the characteristics of the actors engaged in adaptation efforts, and the nuanced interpersonal dynamics of collaborative decision-making and action.

Marks and colleagues' (2001) team processes framework, suggests that teams move through cyclical stages of teamwork, and that within each cycle, outcomes result from a combination of inputs, processes, and emergent states. In the framework, inputs include team attributes and contextual elements that shape team function. Team attributes include factors such as personality types and tasks. Contextual elements include factors such as available resources and social or political contexts. Team processes are the interactions between individuals as they work, such as communication, collaboration, and task division. Emergent states are team dynamics that arise from, and contribute to, inputs and processes, such as trust and ownership.

Place-based climate adaptation workshops and resulting adaptive actions can be viewed as comprising one or more team process cycles or episodes. In this conceptualization, the team is comprised of the individuals collaborating on climate adaptation, regardless of their organizational home or sector. Although climate adaptation processes may involve groups that are only loosely affiliated, and who may not identify themselves as teammates, those involved in these processes share similar functions and experiences to formalized teams. For example, adaptation requires coordinated collaboration across plans, sectors, and actors, with the group in effect functioning as a team aligned around a commitment to a shared goal (Meerow and Woodruff 2020). Adaptation workshops, which generally convene stakeholders from across sectors to conduct vulnerability analyses and identify and prioritize strategies, can be viewed as team performance episodes, in that they are "distinguishable periods of time over which performance accrues and feedback is available," and are associated with "goals and goal accomplishment periods" (Marks, Mathieu, and Zaccaro 2001).

Each of the workshops in this study occurred at its own particular point in time in relation to network development, planning process, and ongoing climate adaptation processes in a particular place. These processes can be categorized within five idealized stages of team development: Forming, storming, norming, performing, and adjourning (Tuckman and Jensen 1977). "Forming" constitutes an orientation phase in which the team is beginning to assemble itself. This continues until conflicts arise in the "storming" phase. As these conflicts are resolved, group norms emerge in the "norming" phase, which entails the development of team cohesion and agreed upon standards of practice within the team. This then enables task performance ("performing") and the eventual completion of the endeavor ("adjourning"). Iterative

cycles of Marks' and colleagues (2001) team processes can occur within each of these stages. We examine each case within its own stage of team development and account for the stage in our analysis of the workshop's inputs, processes, emergent states, and outcomes.

2.1.1. *Workshop inputs*

Past research suggests a range of inputs may influence outcomes of local adaptation efforts, including attributes of the group engaged in adaptation and a range of contextual factors. Group attributes include characteristics of the individuals involved and their relationships to each other. For example, local champions have been found to be especially important for advancing collective action. These individuals commonly serve as key drivers of planning and actions and key facilitators or brokers of relationships between others (Hanleybrown, Kania, and Kramer 2012). In the context of place-based adaptation workshops, local champions could help external facilitators to navigate local norms, communicate the goals of an initiative to the local community, mobilize attendees, and maintain momentum after a workshop (Nkoana, Verbruggen, and Hugé 2018). The diversity of expertise, sectors, leadership roles, and community representation of participants can also enhance team processes and outcomes. Recruiting and sustaining participants with the power to make decisions or implement projects, those directly impacted by potential actions, and representatives from a range of backgrounds and experience may help groups to create a more accurate understanding of the climate impacts on the system of interest and to forestall actions that lead to increased vulnerability to climate change (Bertana *et al.* 2022). Robust networks between these actors can serve as avenues for information exchange, resource mobilization, conflict negotiation, and consensus building (Juhola and Westerhoff 2011; Moser *et al.* 2008). Conversely, actions undertaken in contexts where network members are siloed may result in solutions that maintain the status quo, fail to seize opportunities for systemic change, or lead to unintended consequences (Voulvoulis *et al.* 2022).

Contextual factors may also help to focus or divert the efforts of individuals and networks working on climate change adaptation. Recent experiences of climate-related extreme events—such as flooding, wildfires, or straight-line wind events—can trigger adaptation planning by opening policy windows for action, increasing the salience of climate change, and elevating a community's perception of climate risks (Demski *et al.* 2017). The presence of higher-level policy mandates can also spur adaptive planning, although the quality of local responses to those mandates may vary widely from perfunctory box-checking to more meaningful undertakings (Butler *et al.* 2020). Moreover, the prevailing political context in an area, as well the availability of funding and staff capacity, may influence adaptation efforts (Egan and Mullin 2017; Dilling *et al.* 2017).

2.1.2. *Workshop processes*

Workshop processes are heavily influenced by the format and structure of adaptation workshops. Processes that enable participants to engage in small groups with other motivated participants have been associated with positive outcomes, as have those focused on addressing specific, manageable problems linked to ongoing activities in a

community (Tuler, Dow, and Webler 2020). The presence of credible, expert facilitators can enhance deliberation, promote trust, frame challenges in a constructive manner, keep participants on task, and help groups integrate scientific understanding with other priorities and ways of knowing (Chambers *et al.* 2021; Coleman, Stern, and Widmer 2017). Workshop co-design, a process in which participants are actively engaged in developing, and sometimes conducting, workshops may empower stakeholders, improve the quality of planning decisions, increase the relevance of climate science to a range of problem areas, and improve outcomes (Butler *et al.* 2020; Chambers *et al.* 2021; Fleming *et al.* 2023). In this context, we examined the extent to which the workshops were co-designed in partnership with local community members, as opposed to imposed from the outside.

After a workshop, additional interventions or incentives to act, such as follow-up phone calls or feedback on performance, can help participants bridge the gap between workshop activities and their ongoing responsibilities (McWilliam 2007; Stern *et al.* 2023). Similarly, ongoing coordination led by backbone support organizations can be a key part of efforts to achieve large-scale collaborative impact (Kania and Kramer 2011). Backbone support organizations are entities with dedicated staff and coordination skills to help keep member organizations and agencies on track over time. As part of broader efforts to advance collective action, backbone support organizations have been found to be effective in a range of contexts, including healthcare, non-native species management, and climate change mitigation initiatives (Braun, Kowalski, and Hollins 2016; Chambers *et al.* 2021; Ledley *et al.* 2014; Truitt-Theodorson *et al.* 2015).

2.1.3. *Emergent states*

As team processes play out during and after a climate adaptation workshop, a range of emergent states may arise (Marks, Mathieu, and Zaccaro 2001). We focus on three that comprised Marks and colleagues' (2001) original framework: cognitive, affective, and motivational emergent states. Emergent states may be considered intermediate or proximal outcomes, that in turn, dictate the quality of subsequent interactions and thus influence eventual goal achievement.

2.1.3.1. *Cognitive.* We consider social learning to be a cognitive emergent state. Social learning encompasses processes through which groups collectively learn and share knowledge, thereby enabling collective action (Cundill and Rodela 2012). It is linked to improved natural resource management outcomes and can be enhanced by fostering interactions between distinct organizations that operate at multiple scales (such as local, regional, and national) and by leading participants through activities designed to build new skills (Stern *et al.* 2023; Suškevičs *et al.* 2018). As an emergent state, social learning describes the extent to which common understandings have developed among members of the network. In a climate adaptation workshop, social learning could manifest as shared knowledge of likely climate impacts in an area or a collective understanding of a process for prioritizing adaptive actions.

2.1.3.2. *Affective.* Affective emergent states encompass team members' attitudes, feelings, and emotions regarding others on the team and the overall process. Positive affective emergent states may emerge as strengthened trust and cohesion. These emergent states are, in turn, linked to a range of positive outcomes, such as improved collaborative governance and greater knowledge generation and diffusion within networks

(Stern and Coleman 2015). For participants in an adaptation workshop, spending time working with counterparts from other organizations or sectors could allow trust to develop as individuals learn about other participants' priorities and areas of expertise.

2.1.3.3. Motivational. We consider collective efficacy to be a motivational emergent state. Collective efficacy describes "people's shared beliefs in their collective power to produce desired results" (Bandura 2000, 75) and is associated with the degree of group investment in a collective endeavor and their sustained commitment in the face of setbacks. By participating in a structured workshop process of analysing vulnerability and planning for adaptive actions, adaptation workshops could help to foster a sense of collective efficacy among participants as they develop a logical pathway for action. Higher degrees of perceived collective efficacy, in turn, are associated with greater collective adaptive action, such as activities to conserve water resources or preparations for extreme weather events (Thaker *et al.* 2016).

2.1.4. Outcomes

Outcomes are the results of the processes by which teams utilize and act upon the inputs available to them (Marks, Mathieu, and Zaccaro 2001). They can arise over shorter and longer timeframes, and they can serve as inputs in subsequent cycles of team processes. For example, a formal plan might be the outcome of one team process cycle, which then serves as an input in subsequent cycles during which the team undertakes the planned activity. We consider two categories of outcomes: planning outcomes and action outcomes. Planning involves developing, assessing, and selecting adaptation options (Moser and Ekstrom 2010). Action outcomes can include direct adaptation initiatives (such as infrastructure development, nature-based solutions, or educational campaigns) as well as activities such as monitoring and evaluating the efficacy of efforts (Moser and Ekstrom 2010).

We aimed to build theory based on our empirical findings of the sampled cases about what workshop characteristics may lead to different outcomes related to climate adaptation. To do so, we used Marks and colleagues' (2001) team process framework to identify what inputs and processes seemed to lead to positive emergent states that subsequently influenced meaningful outcomes for participants. We explore these linkages across 30 cases to examine the impacts of climate adaptation workshops on local climate adaptation work. We examined these linkages in a wide variety of social and political contexts and within groups at different stages of team development.

3. Methods

We applied a mixed-method comparative-case case study design. Comparative case studies seek to answer questions about contemporary happenings without demanding tight control of behavioral events (Yin 2009). Following Eisenhardt (1989), our data collection and analysis involved an iterative approach, enfolding additional concepts and frameworks by consulting the literature as new themes emerged.

We employed three data collection methods: interviews with workshop facilitators and local conveners; the collection and review of documents such as agendas, reports, and publications; and surveys of workshop participants. Drawing on multiple data sources can enhance a study's validity and reliability by allowing for triangulation of

different perspectives and affording a more complete understanding of the data (Glesne and Peshkin 1992; Yin 2009).

3.1. Case selection

We included workshops that took place in the United States, involved at least ten participants from a range of stakeholder groups, and lasted at least half a day. We excluded workshops whose geographic scope encompassed entire states or larger regions. This limited our sample to specific geographies where cohesive and tangible adaptation activities could reasonably take place. We included workshops that were conducted from 2017 to March 2020—a range that we felt allowed enough time for meaningful action to potentially result from a workshop, but not so much that participants might fail to recall the event's specifics.

We identified potential cases through three avenues. First, we asked a panel of 22 expert adaptation-workshop facilitators, who were participating in a related Delphi Study (Stern *et al.* 2020), to identify all recent adaptation workshops of which they were aware. Second, we sent out a call for workshops on listservs and other platforms frequented by workshop facilitators, such as the American Society of Adaptation Professionals (ASAP) and the Climate Adaptation Knowledge Exchange (CAKE). Finally, we used snowball sampling by asking the facilitators of adaptation workshops in our initial sample to help identify other possible workshops to include. We contacted representatives from each workshop by emailing facilitators or other workshop organizers. We identified a total of 62 potential workshops that appeared to meet our criteria, and we proceeded with data collection on 33 workshops. For the remaining 29 workshops, we were unable to contact the organizers, or they declined to participate. We observed no specific difference in geography, subject matter, or timing between these workshops and those included in the study.

3.2 Data collection and analysis

Data collection took place between July 2020 and March 2021. For more recent workshops, we waited at least 6 months post-workshop to begin data collection. For each case, we began data collection with semi-structured interviews with the facilitator(s) of the workshop. In the interview, we solicited information about the genesis of the workshop, the context in which it took place, the participants, how the workshop unfolded, and what had happened since. We worked with facilitators to obtain contact information for workshop participants. We then emailed participants an invitation to participate in an online Qualtrics survey. This survey gathered information on participants' goals, goal achievement, workshop outcomes, workshop components, constraints to adaptation, and open-ended recollections of the most and least valuable components of those workshops. We sent a follow-up email to non-respondents after one week, and a final reminder email after two weeks.

Next, we interviewed the local convener(s) for each workshop. Local conveners are facilitators' counterparts who are based in the workshop location. They often help facilitators plan and execute adaptation workshops by identifying and recruiting participants and helping facilitators understand the local context (Stern *et al.* 2023). In instances where no local convener existed, we interviewed workshop participants whom facilitators indicated could speak meaningfully to what has occurred since the

workshop. Interviews with local conveners covered topics similar to those explored in our interviews with facilitators. We asked conveners to help interpret our preliminary summary findings from the surveys of workshop participants as a form of member checking (Doyle 2007). All research protocols involving human subjects were approved by the Virginia Tech Institutional Review Board. All subjects provided written or verbal informed consent, as appropriate, before participating in surveys and interviews.

All interviews were transcribed and then coded by the lead author through an iterative process of identifying and refining themes. These themes were a mixture of concepts identified in prior literature and emergent elements identified inductively. We then enfolded additional literature to contextualize and sharpen these emergent concepts (Eisenhardt 1989). On subsequent passes through the data, additional themes were incorporated, and codes refined and consolidated through axial coding (Saldafia 2009). Codes were discussed and vetted with co-authors throughout the coding process. We calculated descriptive statistics for quantitative survey data and thematically coded responses to write-in questions. We drew upon all data to draft analytic memos for each case describing and interpreting the community context in which the workshop occurred, its genesis and structure, participant and facilitator perceptions of the elements that contributed to positive outcomes, mistakes and missteps, emergent states that arose from the workshop, and the events and actions that took place after its conclusion (Bailey 2017).

3.2.1. *Planning and action outcomes*

We sought to distinguish workshops that participants and organizers felt clearly contributed to adaptation outcomes from those that did not. To do so, we compared across multiple data sources to code whether a meaningful planning or action outcome could be reasonably attributed to the workshop. This involved data from interviews with the facilitators and local conveners, as well as data from participant surveys. Specifically, we drew upon interview responses to two questions about workshop outcomes (What would you say the workshop achieved? What were the outcomes?) as well as questions from the survey of workshop participants (Open-ended: Please describe any meaningful outcomes that you feel happened specifically as a result of the workshop that might not have happened if it had not taken place. Close-ended: Did the workshop help stimulate adaptation actions in the area? Response options: Not at all, A minor amount, A moderate amount, A major amount, I am unsure of the workshop's impact.) We then sorted all workshops into three categories (strong, ambiguous, weak) based on the following criteria: 1) We considered a workshop in the "strong" category if both participants and organizers reported action outcomes that they attributed to the workshop; 2) We categorized workshop outcomes as "ambiguous" if only one respondent type (participants or organizers) reported action outcomes or both groups reported planning but not action outcomes attributed to the workshop; 3) We placed workshops in the "weak" category if neither participants nor organizers reported action outcomes and at most one group reported planning outcomes attributed to the workshop. The absence of evidence of action outcomes does not necessarily mean that workshops were lower impact. However, by comparing multiple data sources, we feel confident that workshops where neither participants nor organizers identified meaningful action outcomes were genuinely different from the workshops we classified as "strong."

Appendix 1 provides further detail on how planning and action outcomes were conceptualized.

We then selected the workshops with the strongest evidence for meaningful outcomes and compared them with the cases with the weakest evidence for outcomes to identify the inputs, processes, and emergent states associated with more effective workshops. Because we rely upon self-reported information from a variety of sources, and because our assessment of outcomes does not provide for definitive cutpoints between workshop outcomes, we were unable to unambiguously rank individual workshops. Rather, we considered the clearest distinctions to be between those with the strongest and weakest evidence for impact and felt that comparing between these two groups could reveal meaningful differences between processes. To make these comparisons, we dropped workshops with ambiguous evidence for impact and sought patterns among the attributes of these higher- and lesser-evidence workshops using matrices and other displays (Miles, Huberman, and Saldaña 2018).

3.2.2. *Stages of team development*

We considered workshops to be in the “forming” stage if interview data indicated the absence of a pre-existing adaptation-focused group or that the group involved fewer than half of the workshop participants. A group was classified as “storming” if interviews indicated conflict related to the team’s work. “Norming” workshops were those where groups were beginning to collaborate but had not undertaken adaptive actions. In “performing” workshops, the group in attendance had already undertaken joint adaptive actions.

3.2.3. *Inputs and processes*

To analyze workshop inputs and processes, we compared across workshop data and memos, seeking areas of commonality and differences. We sought evidence for themes from the literature as well as emergent themes arising from our data. Inputs included factors such as the presence of backbone support organizations, local champions, and the stages of team development. We examined a number of workshop attributes to understand workshop processes, including the duration of the convening; the extent of pre- and post-workshop engagement by facilitators; the nature of workshop deliverables; the use of tools, presentations, breakout groups, and other approaches during workshops; and the use of co-design approaches.

3.2.4. *Emergent states*

We drew upon interviews and surveys to identify emergent states. We considered a workshop to exhibit an emergent state only if we found evidence that it existed beyond a single individual. Cognitive emergent states were indicated by evidence of shared vision or shared understanding among participants, such as survey respondents reporting the development of a shared understanding of climate adaptation strategies within a group (rather than only enhanced individual understanding). Affective emergent states were indicated by evidence of strengthened relationships within the broader group (rather than their individual relationships with other members). Motivational emergent states were indicated by evidence of enhanced feelings of collective efficacy or ownership within the group.

4. Results

4.1. Overview of included workshops

A total of 431 workshop participants from 33 workshops responded to our survey, yielding a global response rate of 57%. Response rates for individual workshops were variable. Although there is no standard minimum adequate survey response rate, 50% is generally considered a reasonable threshold for representing a group (Babbie 1973). In 21 of the 33 workshops, our response rates were at or above 50%. We found that the workshops in our sample with lower response rates also tended to be among the processes with less evidence for impact. Because we drew upon additional data sources, including interviews and workshop documents to corroborate our findings, we felt that excluding all workshops with response rates below 50% risked eliminating opportunities for insights into less-satisfactory processes. We therefore considered a response rate of more than 30% acceptable, as it would account for the likely downward bias in response for workshops with less evidence for impact without eliminating this end of the spectrum. We dropped three cases with response rates below that threshold from our analysis, leaving 30 cases and 404 total survey responses. We also compared non-respondents to respondents by professional sector to examine non-response bias in our sample. We found that workshop attendees affiliated with local government disproportionately responded to the survey, whereas attendees affiliated with academic institutions were less likely to respond. Other groups did not differ in their response rate.

Of the 30 workshops included in the final sample, seven took place in California, two each in Colorado, Florida, Maryland, New Mexico, and Wisconsin, and the remaining workshops were held in Arizona, Georgia, Idaho, Maine, Michigan, Nebraska, New York, North Carolina, South Carolina, South Dakota, Texas, and Virginia. The large number of workshops in California may be due in part to the state's large population, liberal political context, and legacy of leadership on climate change issues (Hirschfeld and Hill 2022).

4.2. Workshop outcomes

Six cases exhibited strong evidence for impactful workshops. Eighteen workshops exhibited ambiguous evidence of impacts. Six workshops exhibited weak evidence of impact. Table 1 summarizes the evidence for planning and action outcomes for each workshop.

The specific kinds of planning and action outcomes reported by participants and facilitators varied within and across workshops. These actions included changes to existing practices (such as planting tree species thought to be more resilient to projected climate impacts), implementing new programs, and outreach efforts, including sharing information internally and externally beyond the workshop. Reported planning outcomes included efforts to incorporate climate adaptation into ongoing planning efforts that had not previously included adaptation, expanding the role of climate adaptation within planning processes, and the production of stand-alone climate adaptation plans. All workshops with stronger evidence of action impacts also exhibited evidence of planning, except one. In Workshop 4, the reported actions were suggestive of behaviors that would require planning, and survey respondents indicated that planning had taken place since the workshop, but neither interviewees nor survey respondents directly indicated that planning activities had specifically resulted from the workshop. They did, however, attribute actions to the occurrence of the workshop. In the

Table 1. Workshop overview and summary of evidence for action and planning outcomes.

| Code | Year | Focus ¹ | Survey responses ⁴ | Evidence for planning ³ | Evidence for actions ² | Actions reported |
|---|------|--------------------|-------------------------------|------------------------------------|-----------------------------------|---|
| Workshops with stronger evidence of impact | | | | | | |
| 1 | 2017 | U | 10/18 | I, S | I, S | Job training program, flood abatement activities |
| 2 | 2017 | NR | 32/43 | I | I, S | Sub-watershed scale adaptation efforts funded/implemented, development of an adaptation tool |
| 3 | 2019 | NR | 8/10 | I, S | I, S | Monitoring, climate smart tree plantings, augmenting air conditioning in facilities |
| 4 | 2018 | NR | 7/23 | – | I, S | Monitoring, adaptation-informed ecological restoration, additional research efforts |
| 5 | 2018 | O | 10/33 | I, S | I, S | Replacement of storm drain culverts, repairs to drainpipes, stormwater system maintenance equipment purchased |
| 6 | 2019 | U | 10/24 | I, S | I, S | Grey/green park stormwater improvements |
| Workshops with ambiguous evidence of impact | | | | | | |
| 7 | 2019 | O | 12/21 | – | I | Land management actions to increase water retention on landscape |
| 8 | 2018 | NR | 17/23 | I | I | Adaptation-informed ecological restoration (shift in tree species planted) |
| 9 | 2018 | NR | 16/25 | I, S | S | Adaptation-informed savannah habitat restoration |
| 10 | 2020 | O | 34/55 | I, S | I | Outreach |
| 11 | 2019 | NR | 18/31 | S | S | Adaptation-informed shifts to grazing and fire management |
| 12 | 2018 | NR | 13/17 | – | I | Wildlife adaptation study proposal submitted |
| 13 | 2019 | NR | 16/27 | I | S | Adaptation informed habitat restoration/preservation efforts |
| 14 | 2017 | NR | 9/21 | – | I | Stream temperature monitoring |
| 15 | 2017 | NR | 7/18 | – | S | Outreach, adaptation-informed vegetation management |
| 16 | 2020 | O | 20/31 | I, S | – | |
| 17 | 2019 | NR | 17/25 | I, S | – | |
| 18 | 2018 | NR | 8/14 | I, S | – | |
| 19 | 2020 | NR | 22/28 | I, S | – | |
| 20 | 2020 | O | 11/22 | I, S | – | |
| 21 | 2019 | NR | 7/12 | I, S | – | |

(Continued)

Table 1. (*Continued*).

| Code | Year | Focus ¹ | Survey responses ⁴ | Evidence for planning ³ | Evidence for actions ² | Actions reported |
|--|------|--------------------|-------------------------------|------------------------------------|-----------------------------------|------------------|
| 22 | 2017 | NR | 8/18 | I, S | — | |
| 23 | 2018 | O | 11/35 | I, S | — | |
| 24 | 2018 | NR | 5/10 | I, S | — | |
| Workshops with weaker evidence of impact | | | | | | |
| 25 | 2019 | U | 4/7 | S | — | |
| 26 | 2019 | O | 18/23 | I | — | |
| 27 | 2017 | NR | 16/22 | S | — | |
| 28 | 2019 | O | 6/19 | S | — | |
| 29 | 2017 | NR | 5/16 | — | — | |
| 30 | 2017 | NR | 4/7 | — | — | |

1. "U" indicates urban-focused workshops, "NR" indicates workshops focused on natural resources. "O" indicates workshops with other/mixed focal areas.

2. & 3. "S" indicates that an outcome was identified in surveys by workshop participants. "I" indicates an outcome was identified in interviews by workshop organizers. "—" indicates neither group identified an outcome.

4. These figures represent the ratio of survey respondents to workshop participants with available contact information. In some instances, we were unable to obtain contact information for all participants. For example, although both workshops 25 and 30 met our threshold of at least 10 participants, we were only able to contact seven individuals from each gathering.

Table 2. Attributes of workshops with stronger and weaker evidence of impact.

| | Workshop ID number | Team development stage | Local champion | Process co-design | Sustained support | | Time post-workshop (years) |
|-----------------------------|--------------------|------------------------|----------------|-------------------|----------------------------|-------------------------------|----------------------------|
| | | | | | External sustained support | Backbone support organization | |
| Stronger-evidence workshops | 1 | Forming | Yes | Yes | Low | Yes | >2 |
| | 2 | Forming | Yes | Yes | High | No | >2 |
| | 3 | Performing | Yes | Yes | High | No | 1 to 1.5 |
| | 4 | Forming | Yes | Yes | Moderate | Yes | >2 |
| | 5 | Forming | Yes | No | High | No | >2 |
| | 6 | Forming | Yes | Yes | High | No | 1.5 to 2 |
| Weaker-evidence workshops | 25 | Forming | No | No | Moderate | Yes | 1 to 1.5 |
| | 26 | Forming | Yes | No | Low | No | .5 to 1 |
| | 27 | Storming | Yes | No | Moderate | No | >2 |
| | 28 | Storming | No | No | Moderate | No | .5 to 1 |
| | 29 | Forming | Yes | No | Moderate | No | >2 |
| | 30 | Norming | No | No | Moderate | No | >2 |

workshops with ambiguous evidence for outcomes, we found partial evidence for action outcomes or stronger evidence for planning outcomes. Because we were unable to identify additional supporting evidence for action outcomes in these instances, we did not consider this strong evidence of impacts.

4.3. Inputs and process attributes of workshops with stronger and weaker evidence of impacts

We identified several attributes distinguishing workshops with stronger evidence of impact from processes with less evidence of impact (Table 2). Stronger-evidence workshops featured local champions and sustained post workshop support from backbone support organizations or external facilitators, suggesting that these elements may be necessary for workshops to achieve more positive outcomes. All but one stronger-evidence case featured workshops that were co-designed with participants, whereas none of the weaker-evidence workshops were co-designed, suggesting that co-design is helpful, but perhaps not always necessary, for achieving impact. Appendix 2 describes the data sources and analyses we used to identify those attributes.

We also examined a range of factors that did not demonstrate a clear pattern within our sample. Factors that were not consistently associated with any category of workshops included the local political context, perceived recent climate impacts, the duration of the workshop, workshop year, insufficient resources, and inadequate leadership. In terms of team development stages, a single stronger-evidence workshop was in the “performing” stage at the time of the workshop. Two of the weaker-evidence workshops were in the “storming” stage and one was in the “norming” stage. The remaining cases of both stronger- and weaker-evidence workshops were in the “forming” stage.

4.4. Inputs: local champions

Each of the workshops with stronger evidence of impact featured local champions, who helped to organize the workshop, recruit participants, and carry forward workshop outputs. For example, Workshop 3 was part of a larger process dedicated to the development of a planning document for a federal protected area. Facilitators recognized the local convener as a local champion and critical to advancing action post-workshop. This is how the champion described his own role in the process: “A lot of it was driven just by me being really passionate about it... I was like, ‘OK, we have all this knowledge, we know what the effects are going to be, now what do we go do on the landscape?’”.

Three of the workshops with weaker evidence for impact featured local champions as well, suggesting that these champions may be necessary but not sufficient for advancing workshop outcomes. The remaining workshops in this category lacked a local champion. Two of these cases involved turnover in personnel who might have served as champions otherwise. The third (Workshop 25) was an adaptation workshop within a larger process that was not primarily focused on climate change. The local convener was closely involved in the larger process but was not engaged in climate adaptation work and did not engage meaningfully in advancing climate adaptation after the workshop.

4.5. Process: co-design

All but one of the workshops with stronger evidence for impact engaged participants in a meaningful process of co-design. Most cases involved facilitators conducting planning calls or exchanging emails with local conveners to identify groups to invite and select focal resources to prioritize during the workshop. However, workshops with stronger evidence for impact included additional engagement strategies that informed workshop design, such as surveying participants about their needs and experiences, conducting a preliminary resilience scorecard assessment, asking participants to complete the opening steps of a workbook, or hosting pre-workshop webinars. They also engaged workshop participants in co-producing workshop tools. For example, Workshop 4 was designed to prioritize actions in and around a federal protected area. It was structured as a two-part process, including (1) an initial meeting to kick off a research project designed to link climate science more effectively to natural resource management, solicit input on key focal species, and identify managers' needs, followed by (2) a meeting that shared preliminary results and an interactive, web-based mapping tool based upon input from the first workshop. The facilitator noted, "People are more likely to use something if they helped build it. A major part is just having them feel that ownership." One participant praised the workshop for supporting the "collaborative identification of priorities, datasets, and management applications... The facilitated collaborative approach was critical."

In contrast, Workshop 29 centered on a federal protected area grappling with projected sea-level rise amid growing urbanization in the surrounding area. Workshop organizers conducted a two-part workshop featuring scenario-planning and Strengths-Weaknesses-Opportunities-Threats analysis (SWOT) exercises in 2017 (Chermack *et al.* 2002; Helms and Nixon 2010). The facilitator noted that the scenario-planning approach did not align with the needs of the participants, who wanted answers instead of explorations of possible futures. Workshop participants seemed to feel that the workshop process was externally imposed, instead of arising from the needs of area residents. The local convener observed:

I really don't know, still, what they were hoping to accomplish. Were they wanting to change agency thinking? What was their goal? ... we, as participants, were like, "Are you happy? Are you satisfied? Are we supposed to do something now?"

Despite the organizing team's efforts to identify an appropriate community for their workshop through an "engagement tour," the process was a poor fit for the perceived needs of the community. This workshop and other lower-performing workshops seemed to suffer from a mismatch between workshop processes and community needs and expectations. Conversely, the sole higher-performing workshop that did not exhibit co-design (Workshop 5) still seemed to meet the participants' needs.

4.6. Process: backbone support organizations and sustained engagement

Two workshops (1 and 4) benefited directly from the presence of a backbone support organization. Workshop 1 was structured as a vulnerability assessment and strategy development process within a multi-sectoral, collaborative initiative designed to coordinate more than 30 organizations to address issues related to racial equity, health, and the environment. Workshop organizers provided little support after the workshop

beyond preparing a summary report from the workshop. However, the backbone support organization transferred leadership of the collaborative group's climate adaptation work to a different member organization. According to the local convener, this shift in leadership was an important outcome of the workshop because it empowered a community-based organization to take charge of the adaptation work. Since assuming leadership of the adaptation work, that organization has conducted a cultural and climate assessment, initiated a workforce training program for green infrastructure, and engaged in arts and other place-making projects related to climate adaptation.

Workshop 25 was the only workshop featuring a backbone support organization that exhibited lower evidence of impact. However, in this case, climate adaptation was not an area of expertise for the organization. The local convener of the workshop, who worked for the backbone support organization, bemoaned the absence of a coordinating organization that was focused primarily on adaptation. "Even with our organization serving as the bridge, it can be overwhelming to incorporate climate adaptation without a local, closely partnered organization to steer the ship."

Workshops 2, 3, 5, and 6 lacked clear evidence of a backbone support organization, but all seemed to benefit from the sustained involvement of workshop facilitators. In Workshop 5, participants developed a short-term checklist of adaptive actions for their communities. Post-workshop, the external organizing team held monthly meetings with participants to help support communities as they implemented the items on the checklist. This support included activities such as enlisting students to do GIS mapping and helping develop emergency communications plans. This sustained support seemed instrumental in forging lasting relationships among people in the area, elevating adaptation as a priority for the region, and enabling meaningful adaptation actions. One workshop participant explained,

Over the past couple of years, much has changed with the assistance of [the workshop team] ... In an update of the comprehensive plan, they provided information, suggestions, and references which were very useful.

Greater post-workshop engagement was the change most often suggested by participants in open-ended responses to a question about workshop improvements. Survey respondents were generally indifferent about whether this support came from workshop organizers or other avenues, such as participant efforts to advance the work. One respondent noted, "There needs to be a commitment by leaders of various agencies, governments, and organizations to continue with meetings and work on implementing what has been taught. There needs to be someone to help with scaffolding, facilitating meetings, and organization – until the group congeals."

4.7. Emergent states

Workshops with stronger evidence for impact were associated with the development of positive cognitive, affective, and motivational emergent states to a greater degree than workshops with weaker evidence for impact (Table 3). Appendix 3 provides additional examples of quotes indicative of the emergent states identified or reported as absent across workshops.

In some instances, we found evidence that the cognitive, affective, and motivational emergent states that arose during the workshops impacted subsequent actions. For

Table 3. Presence/absence of emergent states workshops with stronger and weaker evidence for impact.

| Workshop | Emergent states ¹ | | | |
|-------------------|---|--|--|---|
| | Cognitive: Shared vision; shared understanding Sample quote: <i>It brought together various stakeholders with different priorities and created a unified vision for the future.</i> | Affective: Enhanced relationships; positive attitudes toward group Sample quote: <i>Connections were built with new partners, relationships with already known orgs were strengthened</i> | Motivational: Enhanced collective efficacy; enhanced ownership Sample quote: <i>Each team coming up with their own project ... provided real world examples and allowed for ownership in the exercises.</i> | |
| Stronger evidence | 1 | ++ | ++ | + |
| | 2 | + | + | + |
| | 3 | ++ | + | |
| | 4 | + | + | + |
| | 5 | + | + | |
| | 6 | + | + | |
| Weaker evidence | 25 | + | | |
| | 26 | + | + | |
| | 27 | + | | - |
| | 28 | | + | - |
| | 29 | + | | |
| | 30 | | + | |

1. “+” indicates evidence of one emergent state. “++” indicates evidence of multiple emergent states (e.g. shared vision *and* shared understanding). “-” indicates evidence of the *absence* of that emergent state. Blank cells indicate no evidence.

example, in Workshop 3, organizers described institutional silos that had impeded collaboration before the workshop. The workshop strengthened relationships across those barriers, resulting in greater communication and coordination between departments post-workshop. Conversely, workshop participants from Workshop 28 attributed the lack of action post-workshop, in part, to the failure of the workshop to generate collective efficacy. “There’s nothing really we can do about it, and there’s no action item that came out of [the workshop] to save it. And maybe that’s what’s so sad I mean, we could talk about this to death, but there are some things that are just out of our control.”

5. Discussion

5.1. Team processes and adaptation workshops

To our knowledge, this is the first study that has examined climate adaptation workshops as team processes. Our findings generally align with the theoretical elements of the Team Process Model and suggest that the framework can be applied to local

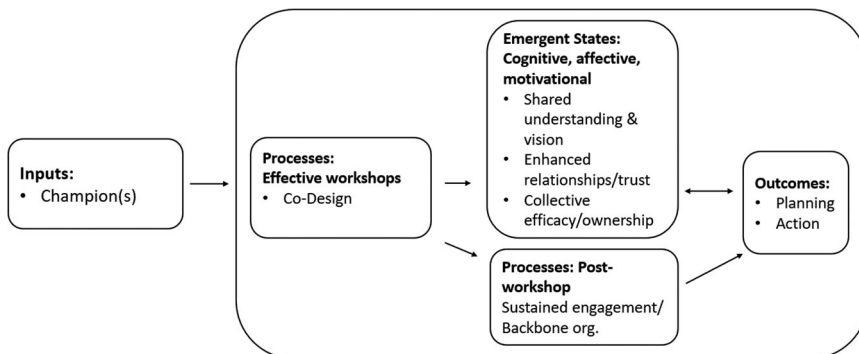


Figure 1. Inputs, processes, emergent states, and outcomes identified by organizers and participants that distinguished workshops with stronger evidence for impact from workshops with weaker evidence for impact within the study.

networks involved in place-based climate adaptation workshops. Because our study relied on a retrospective assessment of the workshops in our sample and treated workshops as a single process cycle, it is necessarily a simplification of these complex and iterative interactions. Nevertheless, we feel that the model yields insights about how these processes function.

5.2. Key findings

All workshops with stronger evidence for impact benefitted from assistance from a backbone support organization or sustained engagement from workshop facilitators in partnership with a local champion who maintained ongoing efforts. Most, but not all, of these workshops also engaged participants in a process of co-design. These inputs and process elements, in turn, contributed to the development of positive cognitive, affective, and motivational emergent states within the group, including shared understandings, deepened relationships, and strengthened feelings of collective efficacy. These emergent states helped workshop participants ease the transition between the workshop process and subsequent efforts to advance meaningful planning and adaptation activities. Theoretically, achieving planning and action goals may then reinforce the emergent states that arose during the workshop in a positive feedback loop (Park, Spitzmuller, and DeShon 2013). These key findings are summarized in Figure 1. Many other factors also likely contribute to the outcomes of adaptation workshops, but Figure 1 represents only those exhibiting clear patterns within our sample.

5.3. Emergent states and outcomes

In complex, dynamic efforts such as climate adaptation, successfully bridging the gap between planning and action often requires ongoing interaction among relevant stakeholders and re-evaluating and adjusting plans (Margerum 2011). Thus, group efforts are more likely to be successful if they garner the support and enthusiasm of stakeholders, incorporate a broad range of perspectives, and generate shared understandings among those responsible for implementation (Margerum 2011; Burby 2003). Our findings suggest that workshops may help to lay positive groundwork for ongoing interactions among workshop participants in part by generating positive emergent states. This association between positive cognitive,

affective, and motivational emergent states and positive team outcomes is supported by prior research on the outcomes of collaborative efforts (Suškevičs *et al.* 2018).

5.4. Local champions

The presence and meaningful involvement of local champions was the sole input that distinguished all workshops with stronger evidence for impact in our sample. Champions helped to organize workshops, recruited participants, and provided momentum and enthusiasm to implement work plans. These functions largely aligned with the roles of champions identified in previous studies (Hanleybrown, Kania, and Kramer 2012). The centrality of champions in our findings suggests that outcomes might be enhanced if workshop organizers focus on identifying and cultivating champions. Organizers could seek to identify individuals whose work responsibilities align with the role of a local champion or who is otherwise likely to have excess capacity, such as a committed retiree. An individual's position within the local network of individuals engaged in adaptation could also signal a potential champion. For example, boundary spanners are individuals who are well-connected within and outside of a given group, and they can play an important role in communication and relationship-building endeavors (Williams 2002). Eliciting commitments from participants at the conclusion of a workshop to take a specific action could reify local champions and encourage new ones (Stern *et al.* 2023). The best predictor of engagement in social movements is whether someone has been asked to join (Meyer 2007).

5.5. Sustained engagement

Sustained engagement in the form of prolonged post-workshop support from workshop organizers or the involvement of a backbone support organization helped workshop participants to navigate the transition from the workshop to subsequent adaptive efforts and reinforced the positive emergent states generated during the workshop. These findings align with prior research about the value of collaborative partnerships that endure over long periods of time and devote resources to monitoring the process and outcomes (Chambers *et al.* 2021; Kania and Kramer 2011). Our findings suggest that external workshop facilitators could temporarily help to fill the role of a backbone support organization in instances where a community lacks a pre-existing entity in that role and where workshop organizers have the resources to stay meaningfully engaged in the community. However, given the long-term nature of climate adaptation and the transaction costs associated with long-term collaborative efforts, time-limited support may be of somewhat limited utility absent the availability of additional resources. Post-workshop support from facilitating organizations may be more effective if organizers are clear in advance about the duration and nature of the support participants can expect after a workshop and if organizers help the community to establish a self-sustaining partnership supporting the flow of information and decisions (Margerum and Robinson 2015; Stern *et al.* 2023).

5.6. Co-design

Co-design emerged as a factor that distinguished all but one workshop with stronger evidence for impact from those with lower impact. In most cases featuring co-design,

workshop participants worked with organizers to develop a tool for their own use. In Workshop 4, for example, by co-developing the climate refugia tool, workshop organizers ensured that the final product would be compatible with managers' needs and that they would feel ownership over the product. In Workshop 6, by iteratively developing a GIS planning tool with workshop participants, organizers helped to ensure that the tool would meet users' needs. In other cases, the participants also played a central role in developing and structuring the workshop. For example, in Workshop 1, a subset of workshop participants gathered relevant data on climate, health, and vulnerability in their focal area well before the workshop began and worked with facilitators to then tailor the workshop to their specific needs. In contrast, none of the workshops with weaker evidence for impact in our sample were co-designed, and, in many instances, we found evidence that these processes struggled to meet attendees' needs. Other climate adaptation initiatives have encountered similar stumbling blocks. For example, in an assessment of five climate service projects, Fleming *et al.* (2023) found that when efforts failed to meet users' needs, it was due to insufficient time and resources allocated to the project, insufficient engagement with key stakeholders, and a mismatch between funder and stakeholder needs.

Co-design has been linked to a range of positive outcomes, such as enhanced legitimacy, the inclusion of additional perspectives within frameworks, increased policy uptake, and greater institution building, (Chambers *et al.* 2021; Fleming *et al.* 2023). Our research suggests that effective co-design may help to ensure that workshops better match the needs of workshop participants, which, in turn, could contribute to the emergence of positive emergent states, such as feelings of collective efficacy and ownership over the process. For some of the workshops in our sample, the co-design process was focused more on developing workshop products than workshop processes. Both instances of co-design align with the concept of co-production, which "can be understood as a deliberate collaboration between actors to achieve a common goal" (Kvamsås *et al.* 2021, 2). Our findings suggest that co-designing workshops or, in instances where the workshop is well aligned with participant needs, co-designing workshop products, can both offer avenues for fostering positive emergent states.

While prior studies have also highlighted the importance of other inputs in driving adaptation workshop outcomes, such as communities experiencing extreme weather events, the presence of policy mandates, the prevailing political context, and the strength of pre-existing social networks (Butler *et al.* 2020; Demski *et al.* 2017), none of these factors cleanly separated stronger-evidence from weaker-evidence workshops in our sample. This suggests that while these and other inputs may shape outcomes, they may not be fully determinative.

6. Limitations and future research

Our analysis relies primarily on self-reported data from workshop participants, facilitators, and conveners. Thus, we lack definitive evidence for the extent to which reported adaptation actions were implemented, and the degree to which those actions may have reduced vulnerability or enhanced adaptive capacity. Our method of identifying and recruiting potential workshops may have resulted in a potential non-response bias, as facilitators of more successful processes may have been more willing to participate. The response rates achieved within individual workshops may have also skewed our findings, as we might have missed outcomes experienced by non-respondents. We

were unable to conduct interviews with additional workshop participants or “ground-truth” reported adaptation actions.

Our methods rather solicited input in a single post-hoc snapshot from organizers and participants about what they felt to be salient at the time we collected data. Our failure to detect other workshop process elements does not mean they were not present nor relevant. Many process elements, such as the duration of the workshops and the use of workbooks and other decision support tools did not vary considerably across the sample. We were thus unable to determine their value.

Finally, because we relied primarily on interviews with participants and organizers to understand each workshops’ inputs, we may not have fully captured all meaningful inputs. For example, the influence of a single champion may have stood out to interviewees more than the strength of the existing network, even if the latter was a powerful driver of the workshop’s outcome.

Future research could seek to redress these limitations and begin addressing additional questions about effective processes for collaborative climate change adaptation. Scholars could investigate the advantages and limitations of facilitating organizations filling the role of backbone support organizations and the duration of post-workshop engagement necessary for groups to become self-sustaining. Studies that examine place-based adaptation workshops as they are developed and deployed, and which follow host communities through time afterwards could help to illuminate how specific workshop elements contribute to outcomes. Such an approach could also help to elucidate the connections between workshop participants’ perceptions of adaptive actions and more objective measures of community resilience and adaptive or maladaptive outcomes.

7. Conclusion

Heretofore, many applications of team process theory have focused on teamwork in workplace or organizational contexts, such as healthcare delivery teams (Schmutz, Meier, and Manser 2019). This study is a novel application of team process theory to the domain of place-based climate change adaptation efforts and an application of team process theory to inter-organizational collaborative efforts. We demonstrate the utility of a team process framework for empirical examinations of the drivers and barriers to place-based climate adaptation outcomes. This study also advances understanding of the drivers of outcomes of place-based climate adaptation efforts by identifying inputs and processes associated with collaborative processes that are more- and less-strongly linked to meaningful adaptation outcomes.

Our findings suggest that a range of inputs and workshop processes contribute to the formation of positive emergent states and subsequent planning and action outcomes in place-based climate adaptation workshops. Given the growing need for—and interest in—conducting climate adaptation workshop to address the urgency of climate change, insights into the drivers of effective workshops could enable organizers to develop and deliver more useful processes. Specifically, workshop organizers could seek to enhance workshops by purposefully intervening at each stage of the team process. When planning a workshop, organizers could identify and recruit likely climate champions to participate in the workshop. If pre-existing champions are not readily apparent, organizers could use registration surveys or other approaches to identify potential champions, and cultivate or mentor them as climate champions. These

champions could form part of the group engaged in workshop co-design with organizers, potentially fostering a stronger sense of ownership while helping organizers tailor the process to the specific needs of the community. During the workshop itself, providing opportunities for participants to learn with and from each other, and to work together on shared problems, could help to foster positive cognitive, affective and motivation emergent states such as strengthened relationships and trust. Continuing to offer mentorship and guidance post-workshop to current and prospective champions could be one avenue by which organizers could sustain their engagement with the community. These approaches could also apply to a broader array of phenomena, such as community-based conservation efforts, stakeholder-driven natural resource management processes, and urban and regional planning efforts.

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Appendix 1. Workshop outcome categories

| Outcome | Definition | Example |
|----------|---|--|
| Planning | Includes planning processes underway and the integration of climate adaptation into formal and non-formal planning documents. | <i>We developed a plan to address climate change impacts for a Federally Threatened species ... in the Recovery Implementation Strategy document we were working on.</i> |
| Action | Actions reported by participants as resulting from the workshop beyond planning, such as grant funding accessed, changes to ongoing practices, concrete projects undertaken, tools developed, and monitoring efforts. | <i>Several projects have been completed ... such as repairs to old, deteriorated culvert boxes and drainage pipes.</i> |

Appendix 2. Attributes associated with workshops with stronger evidence for impact

| Attribute | Description | Data source | Scoring criteria |
|-------------------------------|---|--------------------------|---|
| Local champion | The ongoing meaningful engagement of at least one local individual committed to organizing, convening, and ensuring post-workshop success of the adaptation workshop. In cases where an existing champion left a network before a workshop yields outcomes, we considered that case to lack a champion. | Interviews | Yes: One or more local champions identified. No: No local champion identified, champion(s) constrained by turnover, or facilitators report disengaged local convener/no active champion. |
| Process co-design | Facilitators' efforts to engage a broad swathe of stakeholders and workshop attendees in designing, creating, or implementing the workshop agenda, tools, or outputs. For example, seeking input or co-developing workshop tools, or working with participants to gather data about projected impacts and vulnerabilities would constitute co-design. Assembling workshop proceedings or findings into a report would not constitute co-design. | Interviews and artifacts | Yes: Clear evidence that workshop organizers engaged in co-design. No: No evidence that workshop organizers engaged in co-design. |
| Backbone Support Organization | The presence and meaningful engagement of a backbone organization during the workshop that carries efforts forward post-workshop. We consider backbone organizations those that commit to carrying forward the work of advancing collective action for climate change adaptation post-workshop by committing staff that facilitate dialogue, build public support, advance policy, mobilize funding | Interviews | Yes: Backbone organization meaningful engaged during and after adaptation workshop. No: No evidence of a backbone organization. |

(Continued)

(Continued).

| Attribute | Description | Data source | Scoring criteria |
|-------------------|--|--------------------------|---|
| Sustained support | and/or establish shared measurement. The degree of support from workshop facilitators provided post-workshop. | Interviews and artifacts | Low: No evidence of post-workshop engagement by workshop organizers. Moderate: limited engagement, such as assembling and sharing a workshop summary or report. High: Organizing future meetings, workshop processes structured as regular, recurring convenings, or offering post-workshop services, assistance, or follow-up calls. A minimum of three engagements. |

Appendix 3. Emergent states (or their absence) and emblematic quotes

| Category | Emergent state | Emblematic quote (source case) |
|--------------|---|--|
| Cognitive | Shared vision | <i>It brought together various stakeholders with different priorities and created a unified vision for the future. (10)</i> |
| | Shared understanding | <i>We also have a shared understanding and language to collaborate with other organizations in the region to protect climate change refugia. (4)</i> |
| Affective | Enhanced relationships; Positive view of group | <i>Connections were built with new partners, relationships with already known orgs were strengthened (2) The workshop also played an important role by providing an opportunity for a diverse group of stakeholders to further build a working level of trust and synergy across organizations (and between individuals) ... (1)</i> |
| Motivational | Enhanced collective efficacy | <i>One of the exercises about what we could do in our current role to improve/strengthen combating negative climate effects was eye opening. It helpful to hear what others in my group felt they could do and weigh that against what I think/thought I could do. (7)</i> |
| | Enhanced sense of ownership | <i>Each team coming up with their own project... provided real world examples</i> |

(Continued)

(Continued).

| Category | Emergent state | Emblematic quote (source case) |
|----------|-----------------------------|--|
| | | <i>and allowed for ownership in the exercises. (4)</i> |
| | Lack of collective efficacy | <i>There's nothing really what we can do about it. And there's no action item that came out of that to save it. And maybe that's what's so sad I mean, we could talk about this to death, but there are some things that are just out of our control. (29)</i> |
| | Lack of ownership | <i>I was done with it, and I never returned to it. And having a conversation with at least two other individuals, I was like what do you think? They were like, 'Well, [the organizers] wanted to do this, and they wanted to use [us] as an example. (29)</i> |