

Review Article - social sciences

# From Checkers to Chess: Using Social Science Lessons to Advance Wildfire Adaptation Processes

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## Abstract

This synthesis uses an overarching analogy to outline key wildfire social science lessons and present human adaptation to wildfire as an ongoing process of negotiated trade-offs dictated by the site-specific context of particular places. Use of an overarching analogy allows presentation of cross-cutting concepts or considerations for: (1) documenting local social diversity and determining how it might influence future efforts for wildfire adaptation; (2) understanding how landscape-scale patterns of social diversity or land management influence efforts to ‘coexist’ with wildfire; and (3) determining how alignments between local, regional, and federal influences necessitate diverse experimental adaptation approaches. The synthesis closes with specific recommendations for fostering wildfire adaptation coordinators and systematic processes that help facilitate diverse, tailored efforts from which generalizable best-practices could be derived. This article also outlines key considerations for research or monitoring of emergent organizations and efforts that bridge scales of collective action surrounding wildfire management.

**Study implications:** Synthesis of existing science indicates that efforts to promote wildfire adaptation should be tailored to the unique social circumstances that affect broader landscapes. Approaching tailored adaptation to wildfire requires a series of considerations that help assess social diversity, better conceive of opportunities for community development that span landscapes, and evaluate how efforts at various scales (e.g., local, regional, state) enable or constrain the development of best practices. The overarching analogy provided in this article helps cut across divergent concepts to articulate existing approaches and concepts that can help achieve the above goals.

**Keywords:** wildfire adaptation, community, social science, wildfire, cross-boundary

There is growing acknowledgement that social, cultural, and political considerations have a significant influence on wildfire-management processes, including the production of fire science or programs designed to improve societal relationships with fire as a fundamental component of healthy ecosystems. Yet despite the increased interest in conceiving of wildfire management as a dynamic interplay between societal and

ecological forces, wildfire social science perspectives continue to be somewhat marginalized or conceived of narrowly by many authors and interdisciplinary teams. For instance, some wildfire science and management efforts continue to conceive of social science primarily as the “outreach wing” of advancements from other disciplines, including: (1) as means to understand why human actors choose to adopt or reject mitigation

strategies recommended by fire ecologists, risk modelers, and engineers; (2) in the design of specific “interventions” (e.g., information campaigns, program development, decision-tools) promoting behavioral changes that broader policy or science deem necessary for “improved” fire management (e.g., support for fuel-reduction efforts, use of prescribed fire, performance of fuel reduction around private homes); and (3) in the evaluation or design of collaborations among organizations and agencies aiming to reducing wildfire risk (e.g., land-use planning or emergency-management coordination) (Moritz et al. 2014, Schoennagel et al. 2017, McWethy et al. 2019, Roos et al. 2021).

Although each of the above efforts are critical facets of well-informed, progressive fire management, the broader wildfire field also tends to struggle with the well-documented finding that collective action to reduce wildfire risk and promote its natural role in landscapes (i.e., fire adaptation) often varies dramatically within or across landscapes because of site-specific social conditions (Paveglio et al. 2009, 2015a, 2019a, Varela et al. 2014, McCaffrey et al. 2020). Much existing wildfire science also downplays the utility of social science in helping to conceive of wildfire management as a complex set of trade-offs and negotiations made by a variety of stakeholders—and for which well-designed scientific outputs are only one of many decision inputs across scales (see Sword-Daniels et al. 2016, Bardsley et al. 2018, Williams 2017, or Paveglio et al. 2018a for argument).

The purpose of this effort is to synthesize key lessons from wildfire social science that help conceive of ongoing wildfire-adaptation efforts as a contingent, process-based exercise of strategic choices and synergies that can grow into sustainable, longer-term practices aggregated across time and landscapes. It uses an extended analogy to help cut across related theoretical concepts and academic jargon that increasingly characterize social or “systems” science, and that can inadvertently perpetuate calls for ideal, one-size-fits-all solutions that do not reflect the complex realities of advancing collective action at various scales. I use this analogy to propose a sequence of considerations and questions that can help researchers, policymakers, or practitioners begin to conceive of wildfire adaptation as an ongoing process of negotiating what type of “coexistence” with fire is possible in *specific places* by building a series of structured, collaborative choices that can be tailored to the unique social conditions that continue to influence landscape functioning.

Lessons from a variety of social science disciplines, including sociology, communication, and

environmental interpretation, all demonstrate the importance of *narrative* in facilitating human understanding of complex environmental phenomena, new ideas, or scientific concepts. That is, human beings often conceive of information best when it is organized as a coherent whole featuring clear divisions, recognizable plot mechanisms, “cultural universals” (e.g., conflict, good and evil, freedom, etc.), and a logical temporal organization of ideas (e.g., introduction, rising tension, resolution, next steps) (Fisher 1987, Goldstein and Butler 2010, Ham 2013, Ritzer and Stepnisky 2018). Some of most enduring and impactful tactics associated with narrative storytelling concern the “framing” (i.e., focal elements and tone) of a particular argument, scientific effort, or policy and the ways that its designers compare new or synthesized ideas to existing concepts. Comparisons of this type (e.g., analogies or metaphors) allow audiences to more quickly recognize or build on the information being presented using their existing knowledge. Comparisons also can help frame the foci that humans use to build understanding of an issue by providing saliency to key points that will motivate attitudinal and associated behavioral change (Paveglio et al. 2011, Pezzullo and Cox 2018, Shanahan et al. 2019).

The importance of narrative and associated comparisons are both readily present in wildfire science and management, though they are not always explicitly acknowledged. For instance, historical narratives associated with “fighting” wildfire, the characterization of wildfire as a “hazard,” or its historic “exclusion” from systems through fire suppression are narrative forms of framing, as are more modern conceptions of “living with fire,” “coexisting with fire,” or creating “fire adapted communities” (Pyne 2015, Reid and Belin 2015, Smith et al. 2016, Neale et al. 2019).

Narrative tactics can produce both positive and negative outcomes with regard to the attitudes, values, or behaviors their producer hopes to influence, but they are nonetheless a powerful force in helping people conceive of ideas in new or reimagined ways (Duit 1991, Aubusson et al. 2006, Jones et al. 2014). Accordingly, I have chosen to organize this effort using an extended analogy that helps synthesize select utilities of social science approaches in the advancement of broader wildfire management. More specifically, the following sections outline how findings and perspectives from social science can *help elevate wildfire management from checkers to chess* by reframing it as a longitudinal process of designing varied programs, policies, and strategies (i.e., “moves”) that achieve differential,

but complimentary, progress toward fire adaption. The extended analogy of checkers and chess developed throughout this article helps achieve that reframing by better acknowledging the ways that interactions between diverse sets of individuals, organizations, landowners, and professionals help dictate what is possible in terms of fire adaptation and moves away from simplified notions that best practices for wildfire management can be applied uniformly across locations. In short, this synthesis illuminates initial considerations necessary to better conceive of fire adaptation as a complex adaptive process for which there are not answers, but dynamic understandings and choices that diverse groups or organizations of people use to define their changing relationships with fire—and each other. Accordingly, at least some of the policy and science focus surrounding wildfire should be on forecasting variable processes, programs, or efforts that reflect a broad range of potential advances associated with future fire adaptation. It should also focus on the sequence of actions that might allow variable innovation to take place (Jakes et al. 2011, Paveglio et al. 2015a, 2018, Roos et al. 2016).

Efforts in each of the following sections illuminate how the extended analogy of checkers and chess can help reframe social science as a key influence or protagonist in wildfire management. Those arguments also illuminate considerations for conceiving of collaborative wildfire adaptation at progressively larger or longer scales and help structure suggestions about the advancement of social science as a critical component of interdisciplinary science. The article concludes with a set of directed ideas for advancing ongoing fire adaptation processes.

## Understanding the Dynamics of the Game

Checkers<sup>1</sup> and chess are both played on the same board comprised of alternating spaces. At its simplest, we could think of that board as a landscape inhabited by various actors (i.e., pieces) whose actions affect the structure of fuels, organizations, incentives, norms, and values that have and will continue to influence any individual or collective action with regard to wildfire management in a locality (e.g., disturbance, harvest, preservation, use)(see Steelman and McCaffrey 2011, Ager et al. 2017, Gosnell et al. 2020 for examples). For instance, a game piece occupying one space on the board (e.g., a private timber company with established or evolving harvest practices) not only precludes other

players from inhabiting that space via ownership/management, it may also enable or block other pieces from acting in the service of larger functions occurring in the landscape (e.g., continuation of a fuel break, source of potential risk or mitigation for nearby landowners).

The conventional rules of checkers articulate how each piece on the board starts the game with the same abilities and opportunities. That is, each checker piece can move forward one space in diagonal patterns or remove other pieces from the board by “jumping” them to an open space. Oversimplified or decontextualized management and policy approaches for wildfire management have a similar tendency to assume that all pieces on the board (by analogy, the people in each landscape being considered) operate under the same rules (e.g., what they can or cannot accomplish).

In contrast, the game of chess features multiple categories of pieces, each with their own rules, resources, and relationships to other pieces in the game. The diversity of pieces featured in chess enables exponential growth in the potential moves, situations, and considerations that players need to anticipate when achieving their goals. It also opens up the potential for key synergies, innovations, or collaborations between pieces—ones that leverage the unique skills and resources that each piece exerts on the board, the other pieces, and the pieces of the other player. Expert chess players are renowned for their ability to creatively conceive of potential connections, possibilities, or “paths” for achieving future objectives and anticipating how they might play out during the course of the game. Yet developing such capability—especially when the person(s) who comprise each piece have the dynamic ability to change their perspectives, actions, or abilities—requires a deeper understanding of what influences human behavior and how that evolves as relationships between human actors and their environment change over time (Williams 2014, Carroll and Paveglio 2016, Paveglio et al. 2016, Sword-Daniels et al. 2016).

Robust segments of wildfire social science spanning multiple decades indicate that it may be more appropriate to think of advancing wildfire adaptation in a given community or landscape as a game of chess rather than checkers. This is because each community or landscape often features a diverse array of residents, land managers, emergency management professionals, politicians, and private industry professionals whose relationships, perspectives, values, objectives, and responsibilities might differ meaningfully with regards to wildfire, collective action, or broader environmental

challenges (see Lee 1991, Paveglio et al. 2009, 2012, 2015a, Brenkert-Smith et al. 2011, 2017, Tedim and Leone 2020 for examples). I refer to these meaningful differences among people as *social diversity* in the remainder of this article.

A long tradition indicates that understanding social diversity can help explain place-based divergence in key characteristics that tend to influence how human populations approach ongoing fire adaptation. For instance, existing research indicates diverse human populations operating in a landscape may feature drastically different relationships with natural resources (e.g., extractive, recreational, preservationist), perceived risks or losses associated with wildfire (e.g., loss of livelihood, fear of property damage, concerns about decreases in biodiversity or tourism revenue), and priorities or preferences about strategies for incorporating fire in the landscape (e.g., use of prescribed fire or mechanical thinning, taxation of private homeowners, restriction of future development) (Newman et al. 2013, Stidham et al. 2014, Canadas et al. 2016, Paveglio et al. 2016).

Likewise, the social diversity that characterizes communities or broader landscapes also has a well-developed link to variable adoption of commonly advocated policies, programs, or strategies for managing wildfire risk. Consider existing wildfire science documenting: (1) variable adoption of home ignition zone mitigations across a gradient of rural, suburban, or agricultural residential property owners at risk from wildfire; (2) inconsistent geographic occurrence or differential representation of stakeholders engaging in policy innovations such as forest collaboratives, Good Neighbor Authority or the Collaborative Forest Restoration Program; (3) the myriad of conceptions or criteria used in wildfire-mitigation plans across locations, including Community Wildfire Protection Plans and emergency-management planning efforts; (4) differential success in proposing, planning, and implementing fuel reduction or restoration treatments on private or public lands; and (5) variable recovery trajectories and associated lessons learned from impactful wildfire events (Carroll et al. 2011, Gordon et al. 2012, Jakes and Langer 2012, Williams et al. 2012, Charnley et al. 2017, Al Abri and Grogan 2019, Griener et al. 2020). Existing and ongoing research helps explain such variability as a product of unique patterns of social diversity operating within and across landscapes, and thus dictating the divergent ways in which people choose to coexist with fire (Collins 2012, Paveglio and Edgeley 2017, Paveglio et al. 2018a, 2019a, Rasch and McCaffrey 2019).

Both chess and checkers are games of strategy, not only in terms of seeing how each move might play out given the current configuration of pieces on the board (i.e., the landscape), but in how those current actions are the product of past gameplay and anticipated moves of other pieces. Such consideration also includes the other “player”—wildfire (or more broadly, the environment)—which features its own conflagration of pieces (e.g., fuel types, fire regime history, regional and local climate, etc.) and whose historic framing by human actors as an opponent often promotes legacies focused on its potential detriment to human society (McCool et al. 2006, Calkin et al. 2014, Pyne 2015, Paveglio and Edgeley 2020). Yet in chess, the diversity of pieces, including the legacies of past interactions between pieces and the likely structure of their future interactions, creates a need for additional consideration, options, and choices about the strategies for achieving fire adaptation. With relevance to wildfire management, the current ecological conditions of a landscape (e.g., fuel connectivity, fuel loadings, fire regimes, burn probabilities) are at least in part the product of historic actions, policies, and values created by interactions between people (i.e., pieces) who continue to influence those lands (Carroll et al. 2007, Fischer et al. 2016a, Steen-Adams et al. 2017, Schumann et al. 2020). This includes the important recognition that Indigenous fire practices or experience often greatly predate later colonization by other cultures (e.g., Native American tribes in the United States or Aboriginal people of Australia), and can provide key insight into the coevolution of people and fire across landscapes (see Boyd 1999, Carroll et al. 2010, Christianson 2015, Steffensen 2020). As such, resource managers, policymakers, researchers, or citizens aiming to advance fire adaptation should understand that when they seek to advance or improve fire management/adaptation in a given locality, they are *joining a game that is already in progress*. Assessing the ongoing dynamics, decisions, policies, and relationships that led to the current arrangement of pieces on the landscape and their relevance to one another will be important in choosing strategic moves in *any* direction.

Attempting to influence fire management or adaptation in any given place (i.e., the trajectory of a chess game in progress) also means considering whether and how future actions may change the dynamics (e.g., relationships) between game pieces and the consequences of those actions (Champ et al. 2012, Steelman 2016, Paveglio et al. 2019b). For instance, establishment of a new landscape-level program to prioritize

wildfire risk and resource management incentivizes or forces a broader set of diverse stakeholders to interact in the development of key criteria to allocate limited funding or resources. Such efforts can have a positive impact on the relationships between select groups (e.g., members of a community increasing their trust in local agency representatives, which may prompt additional partnerships). It could also have a negative effect if some actors feel their concerns are not incorporated into the process, they feel they have to compete with one another for legitimacy of their priorities, or they come to realize that existing scientific assumptions do not reflect their values (McGee et al. 2016, Edgeley and Paveglio 2017, Brenkert-Smith et al. 2020, Ghasemi et al. 2020).

The particulars of human dynamics, decisions, policies, and relationships that influence pieces on a given board (what some refer to as social context), and that reciprocally affect their environment, are what social scientists spend their careers developing an ability to understand. Social scientists' methods, training, and approaches are designed to plot the dynamics of pieces that comprise the game and consider how potential moves might influence its progression (see Bryman et al. 2012, Creswell and Plano Clark 2018 for starting overviews). Likewise, social scientists' use of social theory and focus on decision-making or collaboration often search for the possibilities, best practices, or strategic moves for achieving progress in a particular game (e.g., better coordination of fire suppression resources, shared buy-in on collective standards for defensible space around homes, agreement about prioritization of values-at-risk) rather than prescribing answers that apply to every situation (see Ritzer and Stepnisky 2018, Stern 2018, Steg and de Groot 2019 for summaries of theory across disciplines). Certain "hard" science approaches and "interdisciplinary" efforts have a tendency to oversimplify these dynamics, apply them without rigor, or worse yet, ignore them by studying a hypothetical landscape without fully considering the important influence of social context.

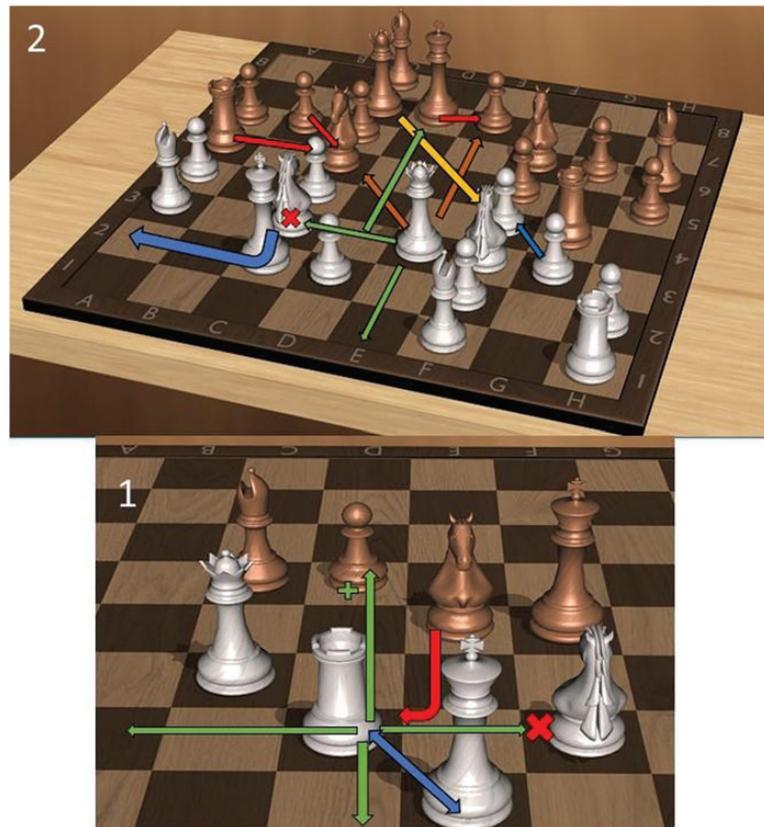
### Attending to Club Rules

As in chess, each piece that is part a given landscape progresses in a "game" of fire adaptation through careful moves that address the different capacities of other pieces, including those of the other player (i.e., wildfire). However, shared or coordinated efforts among pieces on the same team are not a given—they require the right circumstances, resources, and

agreements that create shared strategy (see Lachapelle and McCool 2012, Every et al. 2016, Kelly et al. 2019, Dickinson et al. 2020). Synthesis of existing social science literature demonstrates how understanding and planning for these strategic moves often begins with two critical considerations: (1) choices about the scale and scope at which desired fire adaptation changes might be adopted/perpetuated among people and (2) taking stock of the social diversity present in the local environment where new adaptation efforts are proposed to take place (see Paveglio et al. 2009, 2015a, 2019a, Whittaker et al. 2012, Nielsen-Pincus et al. 2015). Lessons learned about the first two considerations illuminate a third, dynamic consideration that becomes clear with increased understanding of site-specific context; that consideration is (3) determining how unique populations *emerge* across landscapes and the ways interactions within those distinct populations build or facilitate collective action (see Jakes et al. 1998, Paveglio et al. 2012, 2017a, 2018a, Meldrum et al. 2018).

Collectively, the understandings that emerge from the above considerations comprise what we might call the "club rules" of a landscape—they help define the rules and resources that characterize how pieces on the board are likely to interact with one another as the game progresses. Club rules are the product of unique relationships, cultures, histories, and practices that define the people who live in and manage the landscape (Giddens 1984, Carroll et al. 2011, Petty et al. 2015, Paveglio et al. 2016). They also help determine whether and what strategic opportunities players on the board can use to address wildfire in coordinated, strategic ways, which I address below. Given the social diversity that is frequently demonstrated across residential populations grappling with fire in a shared landscape, any piece initiating or collaborating for wildfire adaptation should consider a range of possible strategies, programs, policies, or incentives to facilitate fire adaptation progress (see Paveglio et al. 2015a, 2018a). This is because no one piece on the board is fully in control of others, and thus cannot guarantee that their future moves will be supported or blocked by others on the board (See Figure 1).

At smaller scales or scopes of fire adaptation, a given piece on the board (e.g., residential neighborhood attempting to promote Firewise program adoption among its members) needs to consider whether their proposed means for facilitating wildfire adaptation fits current expressions of the local culture, values, preferences for organizing, or conceptions about



**Figure 1.** Considerations for wildfire adaptation at different scales or scopes. Background images generated using the Chess Prime 3D app by Vinta Games.

**Panel 1:** At smaller scales or scopes, individual groups of actors pursuing improved fire adaptation (i.e., an individual chess piece) need to take stock of the local culture, values, ways of organizing, and conceptions about wildfire risk/benefit that will influence the ways in which they might be able to move (i.e., green arrows, panel 1). This includes determining shared understandings of potential risk from wildfire or what needs to be changed in order to redefine relationships to a surrounding environment (i.e., red arrow, panel 1). That population also needs to consider the potential benefits (i.e., blue line, panel 1) or barriers that other human organizations, groups, neighborhoods, or governments pose to their efforts (i.e., red x, panel 1). The result of these considerations is an articulation of the various moves that individual group might make given the social and biophysical circumstances of the broader landscape and choices about their most beneficial path forward (i.e., green "+," picture 1). See main text for examples relevant to wildfire adaptation.

**Panel 2:** Addressing wildfire adaptation at broader or landscape scales includes consideration of more pieces, a larger area of the board, and potentially a greater sequence of moves. Fire adaptation in more complex social and ecological environments requires considering what unique residential populations, agencies, organizations, governments or groups are operating in the shared landscape. The moves of any one actor still need to consider multiple options given their local context, and potentially additional moves made further into the future (i.e., green arrows, panel 2). However, there also is a greater need to consider coordinated actions or benefits associated with other actors (i.e., pieces) that could yield innovative opportunities, support ongoing adaptation (i.e., blue arrows, panel 2) or hinder its progression (i.e., red x, panel 2). Such coordination requires aggregation of the local context dictating the rules of each piece, and strategic development of shared meanings or initiatives. Finally, landscape-level fire adaptation requires additional consideration of trends, risks, or considerations that take place in the broader environment (for example, yellow arrow, panel 2) or that will result in negative repercussions to communities who do not adequately respond to social and ecological conditions (i.e., red arrows, picture 2). See main text for examples relevant to wildfire adaptation.

wildfire risk/benefit that comprise their own space on the board (e.g., residents who comprise the neighborhood) (see [Figure 1](#)). This includes how those proposed adaptations reflect agreed-upon notions for what is at risk from wildfire or what needs to be changed in terms of its management by local people ([McCaffrey et al. 2011](#), [Paton and Buergelt 2012](#), [Paveglio and](#)

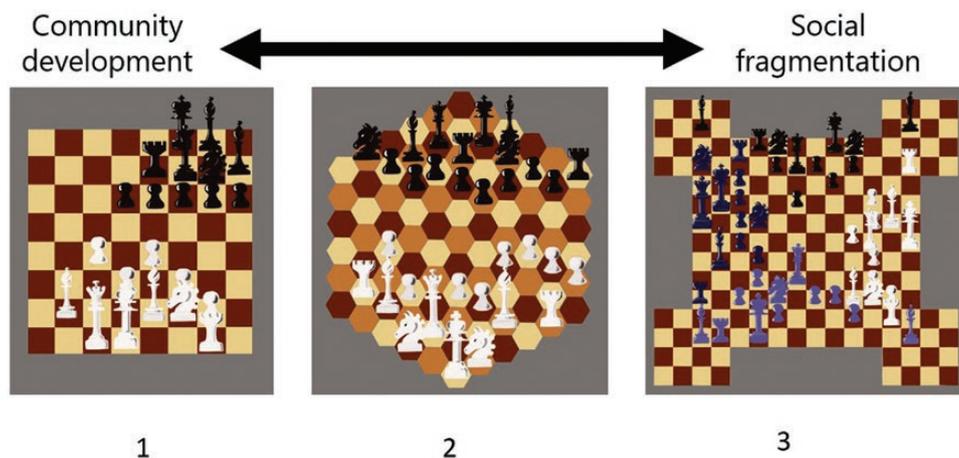
[Edgeley 2017](#), [Cooper et al. 2020](#), [Steffey et al. 2020](#)). Approaches for assessing and documenting this local context, including how they relate to common fire adaptation initiatives, already exist in wildfire social science and are built from longitudinal research on that topic ([Paveglio et al. 2009, 2012, 2019a](#), [Collins 2012](#), [Fire Adapted Communities Learning Network](#)

2021a, b). I discuss ways to use and expand such approaches in the final section of this article. Likewise, efforts to tailor adaptation in ways that reflect local social context are the hallmark of strategy that builds on shared strengths, sentiments, and place-based relationships. Such approaches work with local culture to build shared commitment, and thus the capacity for coordinated action, by establishing the means for interaction among people who use shared meanings and care about their local environment, even if for different reasons. A wealth of science and practical experience demonstrates how approaches that build from and compliment local strengths are more likely to facilitate collective action that can be sustained, even after initial incentives such as grant funding or following impactful fire events (Jakes et al. 2007, Kulig and Botey 2016, Paschen and Beilin 2017, Paveglio et al. 2018b, Carroll and Paveglio 2019).

Residents of our example neighborhood also need to consider potential benefits (e.g., ties to state agency mitigation cost share, conservation district planning help) or hinderances (e.g., distrust of state or federal agencies, county ordinance that restricts vegetation management) that other pieces on the board might pose to their next moves regarding implementation of Firewise. This is because the capabilities of other pieces may influence shared ability to promote fire

adaptation and build connections that include public-private partnerships (see Figure 1) (see Steinberg 2011, Jakes et al. 2011, Paveglio et al. 2015c, Paveglio and Kelly 2018). Finally, planning for strategic adaptation moves also means taking stock of the relationships, common interests, or shared views/objectives of other pieces that members of the neighborhood may interact with in the pursuit of their goals. Those interactions could open up key opportunities for support (e.g., lessons from other neighborhoods that adapted the Firewise), build synergies (e.g., consultation from an agency fuel-reduction specialist) or lead to conflict that blocks adaptive action (e.g., restrictions on a fuel break due to critical wildlife habitat) (Brummel et al. 2012, Fischer et al. 2016b, Jahn et al. 2020). A fuller documentation of the above considerations would provide our hypothetical neighborhood with a clearer understanding of the moves it could make, and provide its members the means to reason through whether their course of action is the best-suited strategy given their circumstance.

Progressing beyond local scales and scopes in terms of fire adaptation raises the challenge of dealing with influences or interactions that span a larger section of the chess board (See Figure 1, panel 2). It also likely means a larger sequence of moves necessary to achieve the landscape-level goals that are currently being promoted



**Figure 2.** The dynamic interplay between social fragmentation and community development. Concept by Travis Paveglio; Art by Amanda Stasiewicz.

Social diversity among populations, landownerships, agencies, and organizations at small scales and across landscapes results in greater amounts of social fragmentation. Socially fragmented landscapes result in a greater amount of management or ecological complexity due to differences in resource management (see additional board spaces in picture 2 or 3) and additional actors whose diverse values, means of organizing, and potential incentives can either complement fire adaptation efforts or decrease their likelihood of success (see additional pieces or teams in pictures 2 and 3). The process of community development, or negotiating coordinated, complimentary fire adaptation strategies that respond to diverse local context, helps simplify the options for progress and build coordinated strategy (see picture 1). Community development does not necessarily seek to reduce social diversity, but works with its site-specific expressions in ways that strategically align skills or resources across the board.

in US fire policy (USDA and USDI 2015, Prato and Paveglio 2018, Charnley et al. 2020). This is because broader landscapes are frequently characterized by a mosaic of distinct human populations, organizations, or agencies whose divergent influence, behaviors, perceptions, or values can fragment the landscape into progressively smaller units where shared action might take place (Busby et al. 2012, Paveglio et al. 2018b, 2019b, Stasiewicz and Paveglio 2018). I refer to this property as *social fragmentation* in the following sections of the article. Each of the distinct residential populations, organizations, or collections of agency representatives who operate in a broader landscape could be thought of as another potential piece on the chess board, and whose unique context should be systematically documented when exploring the potential for coordinated moves among pieces. Put another way, players need to first understand and consider the unique club rules of the landscape and consider how they enable and constrain key opportunities for coordinated strategies if they hope to influence progress in the ongoing game.

Recognizing social diversity and associated social fragmentation in a given landscape also means acknowledging that scientists, when they assert their ideas, findings, opinions, or foci, join the game as just another piece on the board. They can meaningfully influence other pieces, but not uniformly. Information on uncertainties associated with varied strategies for achieving fire adaptation may be of more value or interest to some residential populations, professionals, agencies, or fire managers than others—and their trust (or distrust) in that information is a critical consideration (see Meldrum et al. 2015, Diaz et al. 2016, McGee et al. 2016, Williams 2017, Roberts et al. 2019, Prato and Paveglio 2019 for examples). Similarly, many scientists may not understand, be trained to look for, or attend to the social dynamics that comprise the club rules of a given place. The result can be science that is less suited to affect, inform, or guide the coordinated gameplay of pieces on the board.

### Joining a Game in Progress

It is in considering how to approach landscape-level fire adaptation among diverse populations that the chess analogy can help advance abstract ideas as more tangible understandings. There are many forms of chess beyond the classic board and set of pieces that proliferate in popular culture. Some varieties of chess feature a much smaller board with fewer spaces or game pieces. Others feature a larger board with additional

spaces and pieces (see Figure 2). Taking stock of social diversity across a landscape, including assessing the extent of social fragmentation that might exist with regards to potential fire adaptation, provides one key initial insight about the complexity of landscape-level fire management and the challenge associated with longer-term processes of initiating, supporting, or facilitating coordinated efforts (Paveglio et al. 2019a, b, Cheng and Dale 2020). Likewise, understanding where local people and extra-local interests (through agency representatives or processes) chose to mobilize their disparate skills, resources, and abilities in pursuit of shared actions across landownerships they care about is a hallmark of community development—which can be thought of as the opposing force to social fragmentation. Community development encompasses a number of strategies that build the shared meanings, decision processes, and values that extend across diverse landownership, goals, or mandates to promote sustainable local cultures who take coordinated responsibility for wildfire in ways that reflect their specific circumstances (Wilkinson 1991, Theodori 2005, Matarrita-Cascante and Brennan 2012). Fostering community development with regard to wildfire is a much more appropriate end goal of adaptation because it implies the evolving capacity of people to consider, adjust, and manage their relationship with fire in ways that build collective conceptions for what is at risk in a landscape while allowing wildfire to play a natural role. It allows local people to take ownership of the tradeoffs and assumptions that are inherent in any choices about future fire management and empowers them to use the best available science to chart a strategy to which they can all contribute. Finally, a focus on community development includes the recognition that community is not always a fixed geographic unit, but a process of interaction among diverse stakeholders that can change over time—and who negotiate collective action that serves its members' shared needs (Paveglio et al. 2017b, Sword-Daniels et al. 2016, Paveglio and Edgeley 2020).

Attending to the dynamic interplay between social fragmentation and community development across landscapes thus helps make sense of the scale at which select wildfire adaptation actions might currently be possible across a landscape, which is a key consideration outlined above for approaching fire adaptation. For instance, is the board simple, with only a few pieces who coordinate well and who agree that future land-use regulation can reduce wildfire risk to private property while allowing for prescribed fire use? Or is

the board much more complicated, with small pockets of communities who have divergent views about the efficacy of land-use regulation because of concern about property rights, county governments that might not have the personnel or authority to impose such regulations on rural populations, and where other avenues (e.g., restructuring cost-share agreements, investing in the local fuels-reduction workforce, shared fuel breaks) might be a better first step in a longer process of building shared agreement? (see [Prior and Eriksen 2013](#), [Bardsley et al. 2015](#), [Mockrin et al. 2018](#), [Paveglio et al. 2021](#) for examples of empirical work). The point here is that considering the complexity of social context occurring across landscapes is essential in determining the types or sequence of strategies that are more likely to promote adaptation progress across locations. They also illuminate the ways that existing laws, regulations, or policies might enable or constrain future action (see [Figure 2](#)), which often requires specific but slow changes ([Tedim et al. 2016](#), [Wilson et al. 2018](#), [Edgeley et al. 2020](#)).

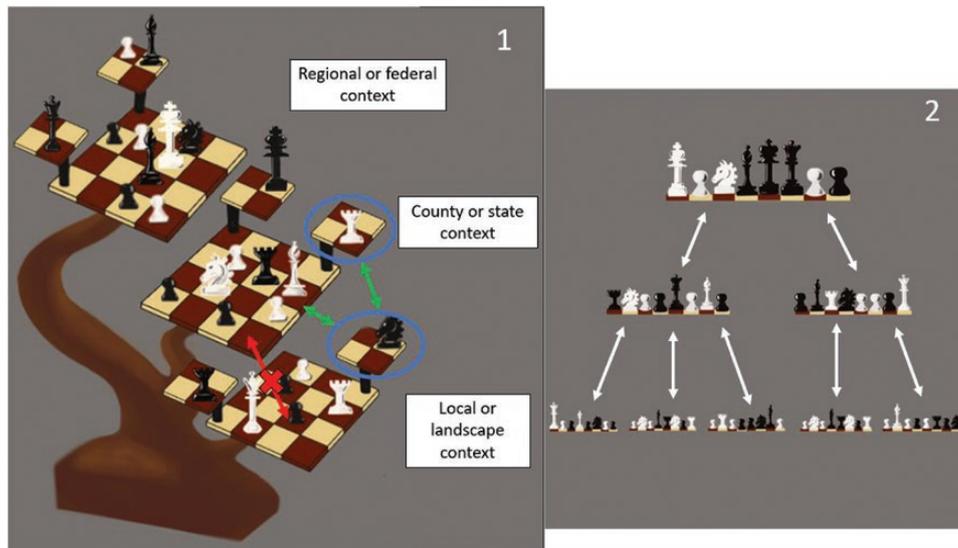
Finally, existing social science research on wildfire adaptation indicates that the types and relationships of human pieces on the board, or their potential influence on external systems that affect wildfire management (e.g., agency culture or best practices, political influence, distrust in government officials) also can differ *across landscapes*. That is, the rules, abilities, authorities, and influence of different pieces commonly found in each setting (e.g., a well-respected landowner, conservation district professional, firefighter, local politician, homeowners association board) may change *across boards* depending on the past interactions among pieces, local values or beliefs, demographics, use of different information, and the objective at hand (e.g., obtaining money for additional fire suppression technology, promoting adoption of Firewise communities, using climate change to frame the need for wildfire adaptation) ([Petty et al. 2015](#), [Paveglio et al. 2017a, 2019b](#), [Kelly et al. 2019](#), [Hartter et al. 2020](#)).

The potential social diversity within and across broader regions leads to a slightly expanded set of considerations for any set of actors hoping to influence the ongoing process of fire adaptation at landscape, rather than local scales. At a minimum, those actors should likely consider and catalog the following about the landscape they engage: (1) what pieces are on the broader board (e.g., industries that could conduct fuel reduction, preservation groups that could influence treatment prescriptions), including the potential animosities of those who are

being displaced (e.g., transition from farming and ranching to residential development), or emerging trends foreshadowing the introduction of new pieces (e.g., amenity migrants moving to rural locations, incorporation of rural fire districts); (2) what each piece on the board is capable of contributing to shared wildfire risk management (e.g., communities with high volunteer fire-suppression capability or authority to require mitigations); (3) the potential influence of a given piece on the movement of other pieces (e.g., a well-known agency fire scientist who can convince county commissioners to adopt fire-specific zoning, a local environmental group that could block restoration treatments through litigation); and (4) the perspectives or perceptions that guide future actions by those pieces (e.g., are links between climate change and increasing wildfire risk a motivation or a deterrent with regards to mitigation action?) (see [Eriksen and Prior 2011](#), [Williams 2017](#), [Langer and McGee 2017](#), [Otero and Nielsen 2017](#), [Paveglio and Edgeley 2017](#) for literature substantiating these categories). Compiling these considerations into a matrix of population or community properties by aggregating lessons at finer scales provides a more detailed look at the social context of an area. That information can then be matched against various initiatives, agreements, cross-boundary projects, or policies to carefully consider how populations might use or adapt them differently, and the most efficient or effective moves for the future.

## Engaging in Three-dimensional Play

Segments of wildfire science and policy focus on ever-broader scales or units of management (i.e., state or national policy, US Forest Service region priorities), including the range of external or political factors that can influence wildfire adaptation at local scales. For instance, a growing segment of research attempts to promote uniform evaluations of wildfire risk, vulnerability, or transmission among landownerships to prioritize limited adaptation resources across regions, states, or entire countries ([Palaiologou et al. 2019](#), [Wigtill et al. 2016](#), [Radeloff et al. 2018](#)). Other authors make forceful arguments about the need to reorganize mandates, budgets, or training standards of agencies such as the US Forest Service to address the increasing budget and personnel burdens associated with evolving wildfire risk ([McWethy et al. 2019](#), [Schultz and Moseley 2019](#)). Such trends are a reminder that the processes of fire adaptation, although most often carried out at the



**Figure 3.** Engaging in the multiscale nature of wildfire adaptation as three-dimensional chess. Concept by Travis Paveglio; Art by Amanda Stasiewicz.

Processes influencing societal trends in wildfire adaptation occur across a variety of scales, including at local or landscape contexts, county or state contexts, and regional or federal contexts. Interactions between representatives of groups, organizations, agencies or governments at each scale (i.e. board) are all part of the same game, and thus influence the foci, programs or funding that guide ongoing approaches for improving fire management. However, key actors transmit information or ideas across scales in an effort to improve fire adaptation across the system. Translation of lessons, ideas, or efforts across scales requires strategic alignment in the values, strategies, and cultures of pieces on other boards through “attack boards” (e.g., blue circles, panel 1). Actors who strategically align themselves on attack boards can influence other pieces across scales through processes of “board hopping,” and thus can better influence fire adaptation at different scales through translation or adaptation of key ideas (i.e., green arrows, panel 1). Local cultures whose values, means of organizing, or culture do not align with those actors on higher boards are less likely to benefit from or influence wildfire policy/adaptation approaches (e.g., red arrow and “X,” panel 1). Scientific inquiry into the ways that different pieces maneuver themselves to attack boards, and how agencies or governments align with fire adaptation on the ground are one key way to better explore equity and success of initiatives across a diverse and much broader number of boards at the local or landscape level (panel 2).

local level, also can have key political, policy, or institutional influences that may be outside their immediate control (Steelman 2016, Handmer et al. 2020).

The recognition that fire adaptation is influenced by local, state, and federal processes implies the need for give-and-take between emergent lessons learned among socially diverse communities attempting to pursue wildfire adaptation and the science or associated policy guiding broader initiatives. Put another way, it is unlikely that a particular chess match will immediately change if the tournament committee alters the fundamental rules part way through a given game. Instead, ongoing lessons from wildfire social science suggest that progress in fire adaptation may be better conceived of as a longitudinal process of negotiating experimental moves across many chess boards and learning from the lessons aggregated across unique games (Jakes et al. 2007, Petty et al. 2015, Williams 2017, Paveglio et al. 2018a). Lessons from those test beds of new strategies or sequences of moves can then

be iteratively integrated into the slow process of policy evolution required for stable systems of local, regional, and national governments (Steelman et al. 2004, Wilson et al. 2018).

One way to conceptualize the range of hierarchical forces (e.g., local, landscape, state, and federal) that combine to influence ongoing fire adaptation across diverse locations is to think of the entire system as a game of three-dimensional chess (see Figure 3). Three-dimensional chess often features multiple boards stacked on top of one another. Each board could be thought of as including diverse pieces representing levels of the hierarchical structures composing agencies, governments, organizations, or scientists who interact as a part of broader policy dialogues about wildfire management (see Field and Jensen 2005, Steelman 2016 or Abrams et al. 2015). We could also think of each board in this conceptualization as progressively larger units of a physical and/or political landscape being described in the extended analogy (e.g., a community and

adjacent landowners, a landscape or county, a state, etc.), including increasingly broader considerations for how fire adaptation should occur across populations or land management units (e.g., focal areas for targeted cost-share mitigation across a state, Forest Service priority rankings for forest restoration or wildfire risk mitigation across a region, allocation of federal recovery monies following wildfire damages given annual budgets).

Interaction between chess pieces on each board in three-dimensional chess are all part of the same game (see [Figure 3](#)). However, pieces on one board can only exert their influence on others by first aligning themselves in key spaces that facilitate movement to higher or lower levels (e.g., what are sometimes called ‘attack boards’). Research on broader patterns of wildfire management and adaptation are beginning to focus on similar dynamics by identifying key ways in which local values or cultures align with fire-management programs, policy strategies, or the values of land and emergency-management professionals representing progressively “higher” boards of wildfire management at broader scales (see [Roos et al. 2016](#), [Hamilton et al. 2019](#), [Steelman and Nowell 2019](#)). Understanding how these strategic alignments or misalignments may occur is another key place where social science approaches are particularly well suited to contribute to broader wildfire management.

Extending the earlier example, certain wildfire research has documented how Firewise programs (or related programs such as FireSmart or FireSafe Councils) are well suited to the needs of private landowners who have recently moved to small- or mid-sized private parcels at risk from wildfire near public lands. This is in part because those populations have a tendency to value professional expertise, require more explicit guidance on how to manage fuels, expect firefighting or resource management services similar to those experienced in more regulated municipalities and are often interested in complimentary goals pursued by agencies such as forest restoration or promotion of wildlife habitat ([Steinberg 2011](#), [Absher and Vaske 2011](#), [Paveglio and Kelly 2018](#)). A number of authors also note that Firewise programs are less used by rural populations with historic or ongoing ties to resource utilization for a number of reasons, including a desire to more actively manage larger tracts of forest resources (including public lands), less need to reduce fuels directly around structures, a distrust of formal programs initiated by extralocal governments, and a desire to generate investments or revenue from resource

use ([McGee 2011](#), [Paveglio et al. 2015b, 2019a](#)). The former group of more recent transplants to fire-prone lands could be thought of as better aligned with the intended audience and conscious policy or programmatic choices that guided the Firewise program and which was ultimately dictated by policy formalized among governments and agencies at state and federal scales.

The point here is not to vilify those who developed or use the successful Firewise program, especially because other programmatic efforts (National Resource Conservation Service outreach to large landowners, Farm Bill programs, Good Neighbor Authority) might provide comparable kinds of wildfire assistance to the rural populations also outlined above (see [Gorte 2011](#), [Kelly et al. 2019](#)). Rather, the point is that a full accounting, understanding, or application of strategies that could be used to advance fire adaptation across diverse populations, including their strategic alignment across scales, might be lacking. Comparatively less research, extension, or outreach contains explicit guidance on how to best match the right wildfire adaptation efforts, programs, messages, funding, or means of organizing across a range of social conditions ([Paveglio et al. 2015c, 2018a, 2019b](#)). Even fewer use those understandings to discover the populations who are underserved by current programs and why ([Ojerio et al. 2011](#), [Adams and Charnley 2020](#), [Cheng and Dale 2020](#)). The result can be a somewhat uncoordinated or incomplete strategy when addressing wildfire at broader scales or the failure to translate fire adaptation innovation to on-the-ground action.

The emergence of landscape-level initiatives such as the Collaborative Forest Landscape Restoration Program (CFLRP) and specialized partnerships such as Rangeland Fire Protection Associations (RFPAs) are additional opportunities to demonstrate how the alignment of values across boards can lead to strategic but divergent advances in fire adaptation. Efforts related to landscape-level work such as CFLRP and RFPAs are the latest highlights in an ongoing discussion about the important but variable influence that collaboratives, environmental organizations, resource-utilization groups, and other arrangements of diverse stakeholders might exert on the process of fire adaptation when negotiating responsibilities with state governments or federal land management agencies ([Abrams et al. 2018](#), [Stasiewicz and Paveglio 2018](#), [Cyphers and Schultz 2019](#)). For instance, RFPAs in Idaho were in part the result of strategic alignments among ranchers who were concerned about loss of forage or grazing rights following fire, Bureau of Land

Management needs to provide fire response in remote areas, and state level needs to protect sage grouse habitat from wildfire threats (Stasiewicz and Paveglio 2017, Davis et al. 2020). The alignment of these and other values led to unique policy partnerships whereby area ranchers gained formal mechanisms for organizing and integrating into fire-suppression response with BLM firefighters, including providing local insight, input, or fire management strategies (Abrams et al. 2017, Stasiewicz and Paveglio 2018).

The above examples could be thought of as efforts by certain chess pieces to translate or exert influence on different boards of the game—to provide conduits through which there can be a better alignment of goals and priorities at different scales (see also Flemming et al. 2015 or Steelman and Nowell 2019). I refer to this process as “board hopping” to extend the larger analogy. In many cases, board hopping entails developing or adapting programs that match the unique circumstances characterizing landscapes or communities where fire adaptation is actually possible. A variety of actors then learn from the results to revise new policy mechanisms that include added flexibility. Organizations promoting their ability to board hop are beginning to gain additional influence at higher scales of policymaking for multiple reasons, including their potential for facilitating partnerships at landscape scales, and because their organizational structures and values may better reflect those with power over resource decisions. Yet it will also be important to assess whether such organizations are being objective, thorough, and accurate in the assessments or lessons being translated, especially given the potential to create winners or losers through the exercise of their influence (Abrams et al. 2015, Cyphers and Schultz 2019, Cheng and Dale 2020).

### Strategic Next Moves

It is likely that further advances surrounding wildfire management in complex systems should focus on applied wildfire science as an iterative process of discovery, confirmation, and generation of alternative means for achieving different conceptions of what it means to coexist with wildfire. It implies a need to learn, adapt, experiment, and document the outcomes of varied waypoints or means for advancing fire adaptation across systems rather than seeking a small set of the most generalizable answers and applying them without innovative application (Paveglio et al. 2015a, 2018a, Williams 2017,

Paveglio and Edgeley 2020). Emerging science and policy are no doubt part of any fire adaptation progress, but they must be bolstered by additional investment in dialogue, decision-making, monitoring, and brainstorming about the shared understandings that influence collective choices about the inevitable trade-offs required to make coordinated moves in diverse landscapes. Social science theory, methods, and best practices can help improve progress surrounding the process-based elements of wildfire management by helping scholars, professionals, and policymakers learn from or better engage games that are already in progress. Importantly, progress in shifting wildfire adaptation toward an adaptive process will require unique types of professional development—the training and empowerment of dynamic *chess players* whose vision, skills, and allegiances need to bridge diverse populations developing shared strategy, and whose abilities allow them to facilitate differential innovations across settings by learning to understand and propose strategies in response to dynamic conditions.

The considerations provided in earlier sections of this article, grounded in an overarching analogy, provide one starting point for outlining key considerations that might help managers, scholars, or politicians better conceive of the dynamic situations where fire adaptation may result in very different means for adaptation. For instance, earlier sections of this effort provide a sequence of considerations that local populations, communities, or broader regions might use to help systematically document the social context that will influence their efforts. Efforts described in this article also use emerging literature to demonstrate how attempts to promote wildfire adaptation at broader scales do not invalidate a need to understand the site-specific context of various pieces that comprise larger landscapes (see for instance Abrams et al. 2015, Steelman 2016, Paveglio et al. 2019a, McCaffrey et al. 2020). Rather, it necessitates the aggregation or efficient assessment of ways that social context operating at various scales interact, including critical considerations as to whether landscape-level action is currently possible given the dynamic interplay between social fragmentation and community development. Finally, I draw critical attention toward documenting whether and how alignments in social context across scales (e.g., values, abilities, interests, or geographies) may result in inconsistent or incomplete adoption of programmatic transformations being advocated on higher boards.

## Developing Common Rules

To begin, considerations for documenting social context should build from and integrate detailed approaches for documenting social context that have already emerged from social science on the topic. For instance, [Paveglio et al.'s \(2009, 2012, 2015a, 2018a\)](#) interactional approach to adaptive capacity (hereafter the interactional approach) developed a set of 22 adaptive capacity characteristics that can be used to help characterize and understand differential community development across a diverse range of social conditions spanning regions of the United States. Descriptions of those characteristics, and their expressions, serve as guideposts for documenting the relationships that unique populations might have with other pieces in the landscape (e.g., professionals, agencies, governments) ([Paveglio et al. 2016](#), [Paveglio and Edgeley 2017](#), [Edgeley et al. 2020](#)). Authors later used characteristics from the interactional approach and 20 years of case study research on local wildfire adaptation, to propose “community archetypes.” The archetypes outline a continuum of local contexts that produce varied values, cultures, and approaches to wildfire adaptation—they provide a means through which communities can learn from others with similar circumstance, experiment with best practices, or more quickly understand how pieces on the board might pursue a variety of coordinated strategies to achieve tailored wildfire adaptation (what they call “pathways”). Finally, recent advancements in the interactional approach outline a range of categories and nested variants of fire adaptation strategies that local communities might consider when determining how to best facilitate fire adaptation given their local circumstance ([Paveglio et al. 2018a, 2019a, b](#), [Paveglio and Kelly 2018](#), [Billings et al. 2021](#)). The Fire Adapted Communities (FAC) Network pursues a complimentary approach to Paveglio et al.'s approach in that it allows members of diverse communities, or their professional partners, to consider a broader range of strategies tailored to local conditions. They also propose interactive processes that might help facilitate how to turn those considerations into actions (see [Fire Adapted Communities Learning Network 2017, 2021b](#)).

Researchers, professionals, and policymakers can use the lessons from either of the above approaches to help consider the broader questions I propose surrounding wildfire adaptation, including the scale at which action can take place, whether a variety of initiatives will fit local culture, and how fragmented or coherent populations may be in terms of their

approaches to wildfire and associated resource management. For instance, documentation of the characteristics defining a given residential population could help professionals and neighborhood leaders decide whether its members will respond to, value, or organize around a new evacuation initiative (e.g., establishment of sheltering points, fundraising for a new egress from the neighborhood, collection and simulation of wildfire progression or spread using remotely sensed data) (see [Paveglio et al. 2012](#), [Strahan et al. 2018](#), [Edgeley and Paveglio 2019](#) for examples). Comparison of the specific characteristics that define the local culture of that population (e.g., desire/ability to stay and defend properties, concerns about maintaining privacy, knowledge about wildfire history or ecology, active homeowners association, etc.) against neighboring human populations, or regarding their willingness to partner with various agencies surrounding fire management initiatives, could also help indicate the level of social fragmentation or potential for community development that could aggregate particular tactics across a broader population/segment of the landscape.

Archetypes, pathways, and similar efforts emerging across wildfire management are a concerted effort to respond to the social diversity that exists within and across chess boards. They provide detailed considerations that help conceive of wildfire adaptation as an ongoing and context-specific *negotiation* about shared strategy among diverse stakeholders. Yet they will also require additional development or utilization to better understand how that context interacts with other pieces in a landscape, or operating on higher boards where many policy decisions are being made. For instance, both the interactional approach and the FAC approaches described above provide real-world examples of the ways that populations form relationships or respond to key external actors when forging their fire adaptation pathways. Yet those efforts do less to implicate the variable way in which land management agency employees, government officials, or business professionals come to adapt or implement the policy guidance being promoted for fire adaptation on higher boards. Likewise, although both efforts implicate a diverse range of activities, grants, agreements, or mitigation actions that might be better suited to different situations, only recently have efforts been made to explore the ways in which community members, professionals, or others use that information to chart their own path toward fire adaptation, including experimentation with specific methods for

achieving those outcomes (e.g., local initiative, consensus workshops, etc.).

The above trends suggest a need for practical scientific advances that help better explain the varied ways local social context might extend to broader community development. For instance, future research could document the key characteristics, personalities, and organizational conditions that facilitate differing priorities or partnerships among agency professionals, local governments, and organizations (e.g., collaboratives). It could also explore how diverse populations access, use, or understand scientific outputs in making decisions that fit their local circumstances (i.e., risk maps, LIDAR data about fuel loadings, strategic suppression decisions). Much of this work is hinted at in existing literature described in earlier sections of this article, but its systematic compilation, and in ways that match the documentation of social context across communities, could help various stakeholders more quickly understand whether strategic moves are possible between pieces on the board. Likewise, there is a critical need to engage professionals, citizens, and volunteers who are actually promoting coordinated action at local levels, and whose efforts provide the promise of dynamic experimentation and lessons learned across diverse contexts (see [Brenkert-Smith et al. 2017](#), [Paveglio and Edgeley 2020](#), [Fire Adapted Communities Learning Network 2021a](#), [The Nature Conservancy 2021](#)). For instance, researchers and practitioners could explore synergies between the FAC and interactional approaches described above. They could examine means for articulating indicators or descriptions of conditions that might help stakeholders quickly recognize the local social context of their board, suggest a sequence of activities adapted from past experience, or match populations with an expanded set of best practices for achieving those outcomes. Likewise, such efforts could reverse-engineer that inquiry to help build training materials or guidelines necessary to help build dynamic chess players who look for unique opportunities and not just fixed targets. By challenging practitioners and professionals to explain why they would advocate for or explore unique mechanisms for fire adaptation within or across populations, researchers, policymakers, and practitioners could help craft “guidebooks,” case studies, or scenario exercises through which new avenues of workforce development might be created.

### Building Better Chess Players

Wildfire social science and broader literature have long recognized the critical influence that “local

champions,” “spark plugs,” dynamic organizers, or “boundary spanners” have in promoting collaborative efforts across circumstances. It is only more recently that calls to promote or use such individuals as key vectors of fire adaptation have become formalized in policy discussions ([Jakes et al. 2007](#), [Paveglio et al. 2015a](#), [Every et al. 2016](#)). For instance, a number of western US states have or are exploring the potential for regional coordinators who would help navigate fire adaptation initiatives among diverse populations, agencies, or interests being asked to develop shared strategy. Western US universities are also promoting faculty extension positions that would aid in these efforts through partnerships with local, state, or federal governments ([Oregon State University 2018, 2020](#), [Washington State Department of Natural Resources 2019](#)).

Interest in fire-adaptation coordinators represents attempts to develop dynamic chess players who can negotiate a variety of boards or help structure fire adaptation as a set of dynamic choices. But their promise also requires a recognition that such individuals would need skills, understandings, methodological training, and unique ways of conceptualizing circumstances that have not always been foundational skills taught to natural resource professionals. Fire-adaptation coordinators would likely need the discipline and vision to approach each new community or region seeking to improve their relationships with fire as a new game that is already in progress. They would need to (1) critically and collaboratively evaluate the place-based strategies that might help populations implement actions best fitting their circumstances, (2) foster or enjoy the respect/authority to suggest changes to programs or policies that might create the opportunities for broader learning, and (3) use or build from local knowledge in each new location where fire adaptation work is taking place.

Some of the key skills required by future fire-adaptation coordinators are likely to stem from the intersection of social science and the environment, including from the disciplines of communication, sociology, psychology, and education. Examples of skills emerging coordinators might need most are those of facilitation, social science data collection methods, communication proficiency, policy analysis, and collaborative team building. Perhaps most importantly, those coordinators need the ability to document or reason their way through various options for fire adaptation appropriate to the social and ecological context of a place, and work to help steer collaborative

processes for advancing different options given what local people are willing to sustain.

Other critical considerations surrounding the development of fire-adaptation coordinators should address with what agency, government, or organization each should be affiliated, how they should be distributed across regions, and the frequency with which they should engage across regions to share lessons. For instance, existing research and practice suggest that even the most objective professional may have a hard time overcoming the restrictions and pressures associated with their parent agency, or in ways that work with the dominant culture of private landowners in an area. Yet making progress in the complex relationships that might foster fire adaptation at broader scales may often require strategically challenging the assumptions or routine practices that stymie new innovation given the changing dynamics of the game (see Kaufman 2006, Steelman and McCaffrey 2011, Paschen and Beilin 2017, Bergemann et al. 2019). Thus, ensuring that coordinators have the freedom and objectivity to seek out innovative mechanisms in support of adaptation across conditions is one way to advance improved “game play” with regards to wildfire, especially among populations not engaging with existing programs or outreach efforts. Finally, there is likely great value in monitoring efforts that follow the development, successes, and challenges of coordinators as they experiment with unique mechanisms to advance fire adaptation across diverse populations. Not only will those individuals help provide the systematic considerations and best practices that build better guides for future action, they will be beneficiaries of new scientific understandings and important translators or testers of improved knowledge in real-world situations. Fire adaptation will no doubt be an iterative process of understanding how tailored design can build more systematic approaches, and those stories are increasingly written on the ground.

### Exploring Alignment and Board Hopping

The discussion of three-dimensional chess in earlier sections of this article implicates a need to explore the alignment of values, ideas, mitigations, and programs being innovated at different scales of human functioning. Advancements in those understandings might begin by considering the conditions, mechanisms, or opportunities that influence the translation of key lessons or ideas among populations operating on boards at different levels (i.e., attack boards). That includes more comprehensively documenting the diversity of

populations that different policies or programs serve and why. Research and practical monitoring could also explore means for capitalizing on the flexibility that is increasingly being added to high-level policies surrounding wildfire management and the ways that pieces on other boards interpret those options.

Another pressing research and practical need relates to the growing interest being vested in board hopping initiatives and organizations. For instance, efforts to promote collectively prioritized fuel treatments or strategic risk-reduction initiatives are indicative of a growing focus on the promotion of landscape-level organizations and collaboratives whose collective functioning is designed to represent socially fragmented landscapes (Fischer et al. 2016a, Cyphers and Schultz 2019, Charnley et al 2020). Yet the accuracy of the latter function remains an empirical question to be fully examined. Directed evaluation of various organizations attempting to serve as board hoppers might begin by assessing whether the decisions, values, and priorities of such organizations are representative of the broader constituencies they represent, including diverse communities that may be impacted differently by broader decisions about wildfire management. Practitioners, coordinators, or researchers could aid such organizations by providing objective external expertise in facilitation, decision-making methods, or evaluation of effectiveness. Additionally, those objective external parties could help document or experiment with ways that board-hopping groups might downscale or contextualize wildfire-management lessons that are often generalized across large scales.

The Kittitas Fire Adapted Communities Coalition (KFACC) in Washington State provides one interesting example surrounding board hopping and its influence on broader fire management. KFACC includes a diverse array of residents, fire- or emergency-management professionals, land management agency representatives, and local politicians who organized following the 2017 Jolly Mountain Fire in the region (KFACC 2021). The KFACC group has approximately 23 regular attendees and approximately 50 infrequent collaborators who meet once a month to plan wildfire initiatives that span broader Kittitas County, discuss potential for collaborations across agencies, organizations or local governments surrounding wildfire and forest management, and reflect on lessons learned from the application or state or national programs in the county. The organization works to secure state and federal grants for wildfire adaptation in the region, communicates with broader organizations about fire adaptation efforts

(e.g., state Department of Natural Resources or other state government, National Fire Adapted Communities Learning Network), and provides key input regarding the practical application of broad approaches such as new zoning or planning standards for residential development in fire-prone areas. Thus, the KFACC group represents an interesting and emergent form of board hopping organization that will likely grow across many regions of the United States concerning wildfire, and which reflects interest in local and regional input into wildfire decisions. Studying how KFACC continues to function or use its unique structure to scale up wildfire adaptation efforts in a socially fragmented, changing landscape, will help inform the critical processes that are necessary to establish sustainable fire adaptation. Likewise, the organization can help contextualize or draw key lessons from the complexity of conditions facing human populations learning to coexist with fire.

## Conclusion

This article uses decades of wildfire social science to demonstrate how wildfire adaptation is a variable and contingent process driven in no small part by the cultures, histories, perceptions, and evolving relationships that people develop with each other or their landscapes. Although fire adaptation is critically *informed* by scientific knowledge, *influenced* by professional action, and *enabled* or *constrained* by broader trends in societal relationships with wildfire, carefully negotiating whether and how diverse populations might agree to implement adaptations in ways that reflect their social context are likely a better way to plan for long-lasting advances in systems where human choice plays an important role. I use the extended analogy of checkers and chess to illustrate how careful conception of social diversity, evolving human relationships, and multiscalar policy, agency, or governmental action have and will continue to characterize human relationships with wildfire. That analogy could be extended in the future to further advance common meanings surrounding processes for better coexisting with wildfire. Finally, the chess analogy helps introduce a series of considerations, opportunities, and associated scientific needs that can help guide ongoing efforts to promote fire adaptation in complex systems.

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## Endnote

1. Checkers is referred to as draughts in some countries.

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