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Assessing Conservation Readiness: The Where, Who, and How of Strategic Conservation in the Sagebrush Biome

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ABSTRACT

The sagebrush biome is rapidly deteriorating largely due to the ecosystem threats of conifer expansion, more frequent and larger wildfires, and proliferation of invasive annual grasses. Reversing the impacts of these threats is a formidable challenge. The Sagebrush Conservation Design (SCD) emphasized that limited conservation resources should first be used to maintain Core Sagebrush Areas (CSA), and then to grow such areas where possible. The SCD heightens the ecological importance of maintaining and strategically growing CSAs. However, the fact that these areas have been identified does not mean that conservation is immediately possible or will be effective. Strategic conservation in the sagebrush biome does not only involve working in ecologically important areas; it is an approach that must explicitly acknowledge the social and administrative conditions in which individuals and organizations are making decisions. We accordingly propose that strategic, durable work can only occur in geographies of “conservation readiness,” that is, where ecological importance, social capacity, and conducive administrative conditions intersect. We offer a framework for assessing conservation readiness that functions as both an inventory and diagnostic tool, highlighting current assets while shining a light on needs and the types of activities that will create or sustain conservation readiness. We demonstrate the utility of the Conservation Readiness Framework for identifying the different roles and activities that must occur at local, mid, and regional levels to nurture conservation readiness over time. In practice, this approach contrasts with management driven solely by ecological importance and illustrates that effective conservation must also involve targeted efforts that curate both social and administrative conditions.

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Introduction

There is an urgent need for strategic, coordinated action to reverse overwhelming losses in the sagebrush biome due to conifer expansion and the mutually reinforcing threats of annual grass invasion and frequent wildfires (Doherty et al. *this issue*). This special issue emphasizes defending and growing core rangelands where it will make the biggest difference in countering losses in the sagebrush biome described in the Sagebrush Conservation Design (SCD; Doherty et al. 2022). The SCD spatially delineated largely intact (i.e., Core Sagebrush Areas or “CSA”), potentially restorable (i.e., Growth Opportunity Areas or “GOA”), and significantly degraded (i.e., Other Rangeland Areas or “ORA”) sagebrush rangelands at a biome-wide scale. Although the SCD is a product that can be used to guide limited conservation and restoration

resources toward maintaining and growing CSAs, conservation is fundamentally a social process, devised and carried out by people. There is a litany of institutional factors—including culture, social norms, regulations, and policy—that determine whether, where, and how individuals, organizations, and communities collectively act to address threats to the sagebrush biome (Wollstein and Johnson 2023). Put simply, just because CSAs have been deemed ecologically important does not mean that conducive social and administrative conditions will magically manifest and enable strategic action to defend or grow these areas.

Because time and resources are limited, we need to be more strategic about where and how conservation is implemented. Strategic conservation is characterized by individuals, organizations, and communities (actors, hereafter) willing and able to strategically coordinate their actions across space, time, and institutions to defend and/or grow CSAs (Boyd et al. *this issue*). Given nearly 60% of the sagebrush biome is public land interspersed with other ownerships (Donnelly et al. 2018), the practical reality of acting to defend and grow ecologically important areas is that those

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actions inescapably occur in contexts suffused by differential formal rules (e.g., land tenure, federal land management statutes) and informal social processes (e.g., community practices, social networks, cocreated meanings; Wollstein et al. 2021).

Conservation in the sagebrush biome is also complex because success requires effectively addressing prevailing ecosystem threats that occur across multiple scales, where the action (or inaction) on an individual parcel often has consequences at larger spatial scales, other jurisdictions, and over time (Cummings et al. 2006; Garmestani et al. 2023; see Creutzburg et al. 2022 for example). That is, decisions and actions at different scales interact. Adding additional complexity, an array of policies, practices, culture, norms, and land tenure all interact on these landscapes and influence the ability to act, actors' priorities, and their selection of activities (Clement et al. 2015). Strategic conservation requires not just the involvement of numerous actors at multiple governance levels (local, mid, and regional); it requires that these actors coordinate their actions by considering how the effects of their decisions and actions will aggregate at other spatial, temporal, and jurisdictional scales (Folke et al. 2005; Wyborn and Bixler 2013; Guerrero et al. 2015a).

Operationalizing strategic conservation in the sagebrush biome, therefore, not only involves prioritizing work in ecologically important areas such as CSAs; it is an approach that must explicitly acknowledge the social and administrative contexts in which the individuals and organizations that make land management decisions are operating and accordingly creating and maintaining conditions that encourage coordination of activities across space, time, and institutions (Clement et al. 2015; Guerrero and Wilson 2017; Wollstein and Johnson 2023). Furthermore, operationalizing strategic conservation must consider how conditions may change or need to be supported through time and at multiple scales (Moon et al. 2014; Guerrero and Wilson 2017). Thus, it includes strategic efforts to support or enhance the social capacity and curate the conducive administrative conditions that enable effective and durable conservation that will defend and grow CSAs.

Here, we briefly describe the institutional context of sagebrush rangelands in the US West, how that context creates or limits opportunities for conservation, and the importance of strategically acting to meaningfully address ecosystem threats. We then offer a multilevel asset-based framework to operationalize strategic conservation involving inventory (mapping) and assessment of three components of conservation readiness: ecological importance, social capacity, and administrative conditions. The Conservation Readiness Framework can be practically applied by local, midlevel, and regional organizations, partnerships, or multi-stakeholder coalitions to illuminate where strategic, on-the-ground work is likely to be effective (i.e., areas of "conservation readiness"). The framework functions as both an inventory and diagnostic tool, highlighting current assets while also revealing needs and the types of activities that will serve to ripen potential conservation opportunities. Lastly, the Conservation Readiness Framework has applications for multiple scales, distinguishing roles and strategies of actors residing at different governance levels, to ensure strategic conservation may be sustainably pursued over time. We conclude by reflecting on how the integration of these components will require the pursuit of cultural and institutional change at multiple levels of governance.

Context

The necessary conditions for sustained and strategic conservation effort depend on local context, and it is difficult for higher levels to be responsive to local variation in the types of investments, support, or authority needed to empower conservation on the ground in different places. For local-level actions to influence

larger-scale dynamics, lower levels have been known to benefit from an overarching plan, such as the SCD (see also Wollstein and Davis 2020). Although such plans tend to lack local nuance (Cash et al. 2006), nesting lower levels within a regional perspective aims to align local actions with larger-scale outcomes (Marshall 2008). Given this, midlevels of a governance arrangement have an outsized role in creating and supporting strategic conservation across scales by bridging local and regional levels, translating higher level expectations to local-level implementers, and communicating local-level resource and policy needs to higher levels (Cash et al. 2006; Marshall 2008; Wyborn and Bixler 2013; Wollstein and Davis 2020).

Addressing the dynamic, persistent problems that threaten the sagebrush biome requires collective actions, work at appropriate and meaningful scales, and the ability to adaptively act in response to emerging information and changing circumstances. But because time and resources are limited, such work cannot happen everywhere or all at once; we need to be more strategic about where and how conservation is prioritized and implemented (Williamson et al. 2018). Specifically, there is a need to become deliberate in 1) promoting conditions that enable coordinated actions across space, time, and jurisdictions, and 2) pursuing activities in ecologically important geographies at scales that will "move the needle" by accounting for social and administrative realities (Creutzburg et al. 2022, p. 179).

"Readiness" for strategic and sustained conservation

Developing conservation plans based on ecological models alone will not usually result in conservation actions or improved outcomes. Yet it is common for conservation planning to rely almost entirely on biophysical data when identifying spatial priorities or strategies (Knight et al. 2008; Sewall et al. 2011; see Doherty et al. 2022 for example). In recent years, it has been increasingly recognized that social factors such as values, norms, motivations, politics, and economic costs must be accounted for in conservation planning, yet appropriate data are often not incorporated (Knight et al. 2010; Guerrero and Wilson 2017). Knight and Cowling (2007) recommend transitioning traditional conservation planning to an approach that embraces social dynamics using "informed opportunism." Similar concepts, such as "conservation opportunities" or "areas of conservation feasibility," have been advanced in the bioregional planning and conservation planning literature (e.g., Knight et al. 2010; Sewall et al. 2011; Moon et al. 2014). For instance, Brown et al. (2019) described conservation opportunities as the intersection of ecological potential, social acceptability, and economic feasibility.

Notably, research integrating social factors to identify conservation opportunities has largely remained in the realm of spatial prioritization for conservation planning, using social data to identify, for example, where social and ecological values align (e.g., Bryan et al. 2011; Karimi et al. 2017). Less attention has been given to social factors that functionally bridge the gap between planning and implementation in the areas identified as conservation opportunities (Knight et al. 2008; Sewall et al. 2011; Guerrero and Wilson 2017). Williamson et al. (2018) used ecological value, social willingness, and institutional capacity to spatially predict where conservation is most critical and likely to be implemented.

We contend that while these conceptions of conservation opportunity, feasibility, and likelihood of implementation can address the question of where conservation could occur (and make a difference), the matters of who to engage (i.e., which actors and at what levels) and when, and their roles within a conservation planning and implementation process remain opaque.

The who, when, and how questions of effective conservation implementation require an explicit reckoning with the in-

stitutional context, that is, the system of formal and informal rules that structure social processes. Because conservation in the sagebrush biome requires collective action to address threats at multiple scales, we examine social-relational and administrative components of the institutional context. Social-relational factors include, for example, the actors involved, social relations and networks, cross-scale dynamics, willingness to participate, and collaborative capacity. Administrative conditions involve authority to act, resources to act, formal and informal procedures, and rules and regulations (Wyborn 2015; Clement et al. 2015; Guerrero and Wilson 2017). The status and interactions of social and administrative conditions within areas of ecological importance contribute to whether conservation actions are meaningfully implemented, effective, and durable. For an organization such as a Bureau of Land Management (BLM) District office, these social and administrative conditions include having staff with capacity to complete requisite monitoring (a mandate for multiple uses on BLM lands), authority and resources to carry out activities specified in the plan, or relationships with other landowners or managers to engage in cross-boundary work (Wollstein et al. 2021).

Thus, we extend the concept of conservation opportunity to conservation readiness, which we define as a combination of conditions that indicate areas that are ripe or have the potential to become ripe for implementing strategic conservation. Conservation readiness occurs in places of ecological importance and when there is also social capacity for collective work to occur and conducive administrative conditions (i.e., authority and resources to act). In short, conservation readiness in the sagebrush biome is characterized by a suite of actors that have the resources, authorities, and willingness to strategically coordinate their actions across space, time, and institutions (Wollstein and Johnson 2023; Boyd et al. [this issue](#)).

Components of conservation readiness

Ecological importance, alongside conducive administrative conditions and social capacity, constitute conservation readiness (Fig. 1A). The concept of conservation readiness aligns conservation planning with current community assets, pragmatically considering where organizations or partnerships operating on vast landscapes could feasibly and effectively focus and sustain their strategic conservation efforts. Conservation readiness is not binary, nor is it static; components may need to be nurtured for a place to reach readiness, and they may fluctuate over time in response to ecological, social, economic, or political dynamics (Beever et al. 2014). We describe each of these components and their interactions below.

Ecological importance

Definitions of ecological importance reflect an organization, mixed stakeholder group, or collaborative's vision. Here, we consider ecological importance using the classifications presented by Doherty et al. (2022). In their framework, cover of annual herbaceous vegetation, perennial herbaceous vegetation, shrubs, and trees, along with an estimate of the level of human impact, are used to characterize the degree of "intactness" of sagebrush plant communities; with CSAs being largely intact and ORAs being least intact. In practice, these classifications strategically inform the geography of conservation efforts, allowing managers and planners to determine where preventative measures can be used to "defend" CSAs, restorative practices can grow core areas (i.e., GOA), and where containment practices can help mitigate impacts (i.e., ORAs). Collectively, this knowledge helps to inform the most efficient spatial prioritization of management activities to ameliorate threats to the ecological integrity of a planning area (Boyd et al. [this issue](#); Reinhardt et al. [this issue](#)).

Wildlife-focused groups might consider greater sage-grouse (*Centrocercus urophasianus*) habitat maps to conceptualize ecological importance, while restoration-oriented groups might be interested in areas where they are most likely to be successful in targeting efforts following a disturbance event (e.g., Anthony et al. 2023).

Conducive administrative conditions

Effective conservation of the sagebrush biome requires actions that are coordinated and strategically deployed at scales that meaningfully address the primary threats causing ecosystem dysfunction (Wollstein and Johnson 2023). This means that all, or at least nearly all, individuals and organizations that influence and carry out the management of ecologically important geographies must have the resources and authorities needed to engage in coordinated conservation actions.

In a practical sense, if actors lack authority and sufficient resources it is unlikely they will complete an objective. For example, an individual landowner or manager can treat invasive annual grasses growing only on their own property, that is, they lack authority to act on other jurisdictions. Likewise, they might only be able to implement treatments if they have financial resources or access to technical expertise. Although a simplistic example, on the mixed-ownership landscapes characterizing much of US Western rangelands, piecing together authority and resources to act across an extensive landscape becomes increasing difficult and yet important (Epanchin-Niell et al. 2010). Whether conservation actions, such as fuels reduction treatments to modify fire risk, can be coordinated across large landscapes is consequential for addressing threats in the sagebrush biome.

In short, individuals and/or organizations across landscapes need to have: 1) authority to act, and 2) resources to plan and implement needed actions. We detail these two categories of administrative conditions below.

Authority to act ("rules")

Authority to enact management decisions is fragmented among different individuals and organizations across spatially extensive, multijurisdictional landscapes. On public lands, organizations must have the applicable federal, state, and local clearances to legally act. For example, the National Environmental Policy Act (NEPA) requires that most decisions that enable substantive action on federal lands follow what can often be a time-intensive process involving environmental analysis and public input. NEPA and other applicable clearances must be secured to undertake management actions to address ecological threats. Yet in sagebrush rangelands and other settings with high environmental variability, it can be challenging to match NEPA timelines with emergent ecological needs (Wollstein et al. 2021). As such, clearances at programmatic levels that facilitate timely actions across broad geographies represent an important enabling condition for effective conservation.

Similarly, Rangeland Fire Protection Associations (RFPAs) are landowner-led organizations authorized to provide wildfire response on private lands and where they have cooperative agreements with federal agencies on eastern Oregon and southwestern Idaho rangelands. Because RFPA members are largely ranchers, granting members authority to act when fire threatens their forage base exemplifies a conducive administrative condition for enhancing fire response on remote rangelands and limiting the occurrence of large-scale fires (Abrams et al. 2017).

Resources to act ("tools")

Those engaged in the management of ecologically important areas must have the financial, technical, and human resources needed to plan and carry out coordinated activities. Availability

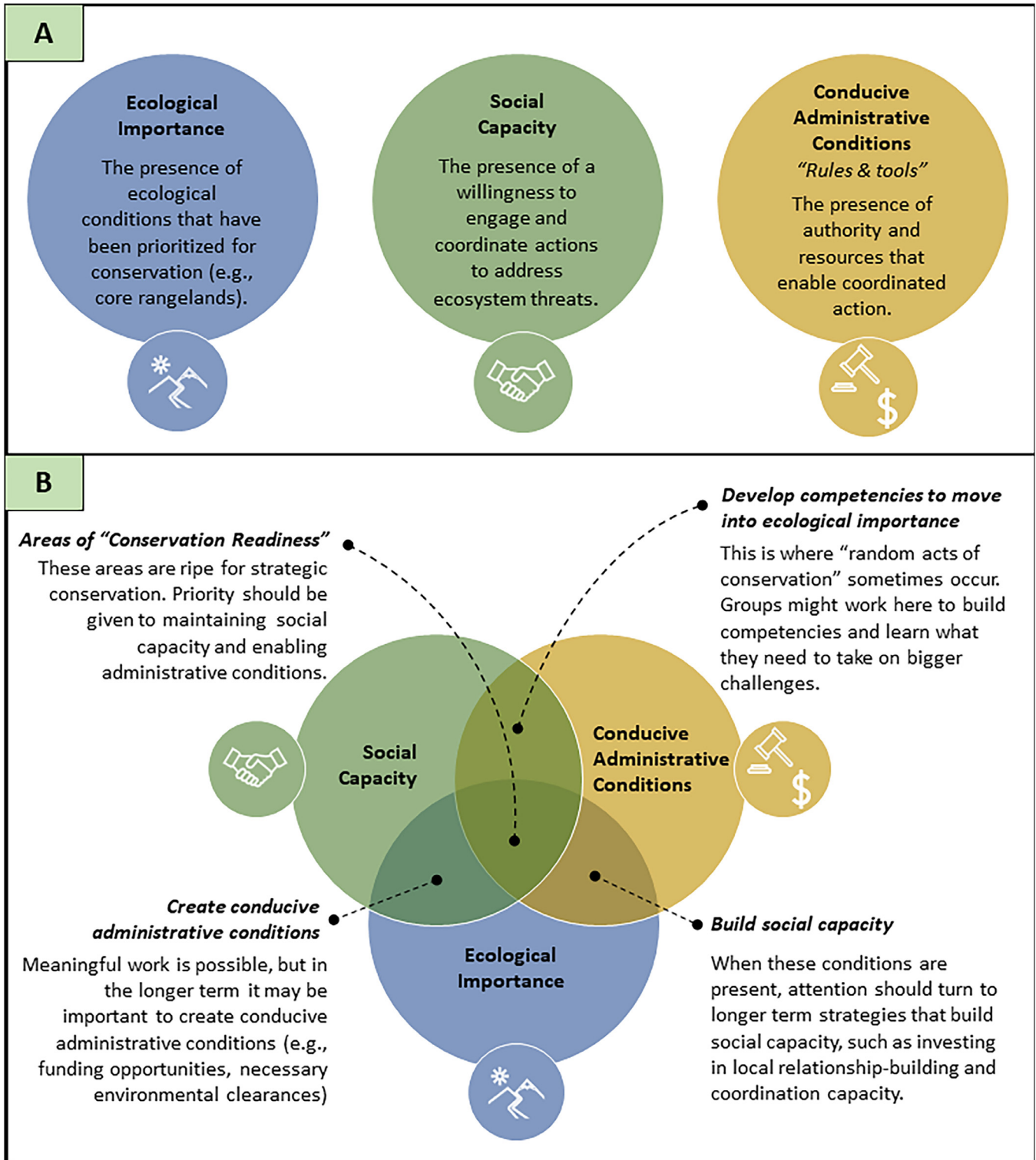


Figure 1. (A) Components of conservation readiness. Each can be mapped through an asset-based process; (B) Conservation Readiness Framework illuminates where strategic, on-the-ground work is likely to be effective. Application of the multilevel asset-based framework also helps users identify different types of work that may need to occur to “ripen” potential opportunities and/or ensure strategic conservation strategies are sustainably pursued over time.

of resources across broad ecologically important geographies is a critical enabling condition for supporting coordination capacity and incentivizing cross-boundary conservation actions. Such conditions can be created through a variety of multiyear funding mechanisms, such as the Natural Resource Conservation Service (NRCS) Regional Conservation Partnership Program (RCPP), which supports capacity- and partnership-building and coordinated pre-

vention, restoration, and containment activities for defending and growing core rangelands.

Social capacity

Whether people have capacity and willingness to engage in strategic conservation is the third component of conservation

readiness. We refer to this as social capacity, actors' willingness, and ability to engage in collective action within a particular geography. Collective action, rather than mere cooperation, is essential to address threats to the sagebrush biome; strategic conservation means that actions are coordinated and strategic, so they meaningfully influence ecosystem outcomes. In this, different individuals and organizations' actions on a landscape are interdependent. For better or worse, they contribute to the collective's outcome, regardless of landownership (Wollstein and Johnson 2023).

We include social capital in actors' willingness and ability to engage in collective action (Auer et al. 2020). Social capital, the structure of social relationships, is indicated by trust, relationships, reciprocity (i.e., the give and take of relationships), formal and informal rules for social interactions, and connectedness through networks (Pretty and Ward 2001). Networks between individuals, within communities, and between communities and external organizations facilitate information and resource exchange, learning, and stabilize social interactions through the codvelopment of norms and expectations (Scarlett and McKinney 2016). Tracing networks in rangeland communities and other rural places is particularly challenging because communities are spatially diffuse (Wyborn 2015). Instead of geographic proximity such as distance to neighbors, social bonds and shared meanings developed through networks create social cohesion and shared norms that better define the extent of a community (Paveglio et al. 2017). In short, social capital grows as relationships are strengthened through interactions (Bergmann and Bliss 2004); higher levels of social capital are related to higher levels of collective action (Auer et al. 2020).

High social capacity for strategic conservation necessitates some shared goals surrounding conservation of the sagebrush biome, regardless of differences in interests, values, or organizational mandates. Consequently, social capacity is also indicated by some number of people who mobilize around an issue because they perceive a benefit from engaging and collectively acting with other entities within their geography (Hauptfeld et al. 2022). This mobilization or coordination of different individuals and organizations toward a shared outcome can take on different forms; it may manifest through informal patterns of interactions within a community or network of partners or is detectable through more formal means such as the presence of a natural resource-focused collaborative (Guerrero et al. 2015b). For example, private landowners in California were willing to cooperate across landownership boundaries around initiatives that affected their livelihoods such as pest control and fire hazard reduction (Ferranto et al. 2013). For strategic conservation in the sagebrush biome, ecosystem function likely intersects with several interests, including wildlife, ranching livelihoods, rangeland resources, and fire protection. Thus, issue framing ("What brings people together here?") may aid in understanding the spatial extent of social networks, especially where communities are not clearly defined.

Lastly, collective action is not an activity that all individuals are performing at all times; sometimes no actions are necessary, different actors have different roles at different times, or new partnerships or ways of organizing may materialize as new issues emerge. Thus, social capacity is not either present or absent in a place; it is a relative continuum of interactions or potential for interactions as they become necessary.

Conservation Readiness Framework

The three components of conservation readiness are interactive and dynamic. They can be spatially visualized ("mapped") and situated in the Conservation Readiness Framework that accounts for these interactions and informs the types of activities (i.e., in which domain) may need to be curated for strategic conservation to be possible or sustained. This framework can be practically applied by

organizations, partnerships, or multistakeholder coalitions to their geographies of interest to illuminate areas ready for strategic conservation. The framework functions as both an inventory and diagnostic tool, highlighting current assets while teasing out needs and the types of activities that will ripen potential opportunities. Lastly, there are applications for multiple scales, identifying and distinguishing roles, strategies, and short- and long-term activities of actors residing at different governance levels, to ensure strategic conservation may be sustainably pursued over time.

We first describe how the different components of conservation readiness can be visualized through an asset-based mapping process within landscapes of geographic relevance to users. The features of the components are often nuanced and contextual and are best conceptualized as continuous, rather than binary. Accordingly, we offer potential indicators and guidance that may aid groups in inventorying their assets within their geography. Next, we detail how orienting the mapped components within the Conservation Readiness Framework aids groups in 1) visualizing how conducive administrative conditions and social capacity align (or do not align) with areas of ecological importance within their landscapes, and 2) diagnosing needs related conservation readiness and the kinds of short- and long-term activities that must occur (by whom and at what scales) for conservation that is actionable and strategic.

Throughout the following sections describing mapping and applying the Conservation Readiness Framework, we point to an example from the Prineville Sage-Grouse Local Implementation Team (LIT) in Oregon to illustrate how a collaborative mapped the three components and situated them within the Conservation Readiness Framework to discuss opportunities and needs in order to work within ecologically important areas for greater sage-grouse in the LIT's area. LITs, collaboratives created through Oregon's 2015 Sage Grouse Action Plan, identify priority areas for sage-grouse habitat conservation and support landscape-level actions to address habitat and population threats within their respective geographies (SageCon Partnership 2023). The Prineville LIT area covers over 1.2 million ha located in central Oregon, in the northwestern edge of the Great Basin.

Mapping components of conservation readiness

We discuss applying the Conservation Readiness Framework using a participatory mapping process with sets of actors within a geography to inventory assets and diagnose needs for each of the three components of conservation readiness. An asset-based approach is appropriate, as it focuses on the strengths, opportunities, and resources currently within the community/geography to identify priorities and collective actions (i.e., either conservation action within ready areas or components to build it). Assets are those of individuals, such as skills, local knowledge, leadership; organizations, such as existing programmatic NEPA clearances within a BLM District, or NRCS funding programs for private landowners; or an entire community, such as social networks, partnerships, or collective experience adapting to wildfire (Kramer et al. 2012; Alevizou et al. 2016). Given the nature of this information, data used to map particularly the social and administrative components may be spatially explicit but qualitative in nature (e.g., the spatial extent of an NRCS program offering, or "What have relationships been like in this place?").

In our experience, the act of mapping each component as a group in a single event or over multiple encounters offers participants a venue for reflecting on relationships and opportunities (e.g., "What assets are important for whom? Under what circumstances?"). Community asset mapping, drawing on maps and spatially visualizing assets and deficits (needs), ties stories and experiences to places, within and around communities and in ecologically important areas. The outputs of a community asset mapping

approach are not just three “layers” of spatial data (one for each component) overlaid to highlight areas ready for conservation; the coproduction of the layers themselves through a participatory process is generative, illuminating opportunities to explore conflicting objectives, constraints of actors, and conditions that may need to be changed (Alevizou et al. 2016; Brown et al. 2019).

Ecological importance

Ecological importance, as used here, relates to the “intactness” of sagebrush rangelands within a management area. The designations of CSA, GOA, and ORA are used to describe ecological importance (Doherty et al. 2022). These descriptors are set within the strategic paradigm of first defending CSAs from undesired change, and secondly growing CSAs using management practices applied largely within GOA. In practice, the spatial arrangement of CSAs, GOAs, and ORAs helps to inform prioritization for maximizing core habitats within a management area. Thus, the spatial prioritization approach outlined in the SCD can be used to delineate ecologically important geographies as CSAs and related GOAs.

For groups focused on resource concerns beyond sagebrush ecosystem integrity, conceptions of ecological importance should reflect the group’s vision or purpose. For instance, the Prineville LIT used Oregon’s Priority Areas for Conservation (PAC) maps in addition to the SCD to map the ecological importance component. PACs are identified by Oregon Department of Fish and Wildlife (ODFW) and considered to be areas essential to conserve Oregon’s sage-grouse population and include core and low-density habitats (ODFW 2023).

The LIT considered the SCD to be an appropriate supplementary product because the mapped CSAs and GOAs represent the “intactness” of the sagebrush ecosystem, a concept aligned with the LIT’s vision. In using the two visualizations, the Prineville LIT agreed on two areas of ecological importance in the eastern portion of the LIT (Fig. 2). Other collaboratives or partnerships seeking to map ecological importance may be interested in decreasing wildfire risk on their landscape. To map ecological importance, they might look to products such as a quantitative wildfire risk assessment for information on likelihood of wildfire and its effects on rangeland vegetation condition (e.g., McEvoy et al. 2023).

Conducive administrative conditions

Inventorying and mapping administrative conditions require that those individuals and organizations knowledgeable about such conditions within the geography engage in an information-sharing process that includes identifying where current authorities, priorities, and resources exist within the area. On public rangelands, relevant information includes landownership and the spatial extent of existing clearances to act for which federal agencies have a Record of Decision authorizing, for example, fuel reduction, conifer management, weed, or other vegetation, fuels, or land management treatments. It also includes existing or future large scale project areas on public rangelands that agencies have prioritized for prevention, restoration and/or containment activities. Other critical information to document includes the geographic extent of areas prioritized for existing funding opportunities. This could include funding opportunities and eligible areas under Farm Bill programs, such as geographies and related resource objectives prioritized for Environmental Quality Incentives Program funding within NRCS Districts’ Conservation Implementation Strategies, and areas delineated to receive funding from NRCS RCPPs.

To create the conducive administrative conditions layer, information on the spatial extent of different organizations’ administrative clearances (rules) and program offerings (tools) is gathered and compiled onto a single map. The process of coproducing this

layer allows partners to reflect on, generally, where there is (or is not) a concentration of administrative opportunities that represent avenues for future action.

In a facilitated workshop session, members of the Prineville LIT were invited to individually draw on a map to indicate the extent of their respective organization’s rules and tools (Fig. 2). Individuals from the BLM, Forest Service, NRCS, Soil and Water Conservation District (SWCD), and other organizations delineated and described existing administrative conditions associated with specific locations within the LIT area. For example, Crook County NRCS and SWCD indicated they provide programmatic funding for private landowners to implement sage-grouse habitat conservation projects in low density and core areas in the southeastern portion of the LIT. A member of the facilitation team concurrently digitized the map drawings in Arc GIS Pro, assigning colors to each organization’s polygons and capturing details in an attribute table.

Social capacity

Mapping social capacity involves characterizing the nature of relationships within a place and connections between actors, either as an asset or a venue for future relationship building (Mills et al. 2014). A spatial visualization of social relationships and networks provides insight into where, in a geography of interest, social capacity is relatively high or may need to be built over time. Community asset mapping seeks to capture information about networks, relationships, social capital, and if and how people mobilize and around what issues within the geography of interest (Kramer et al. 2012). To understand the nature of relationships and whether and when they are assets, it is necessary to capture contextual details about interactions (Chazdon and Lott 2015). Because information on social conditions is contextual and nuanced, this process largely uses qualitative information—the qualities of a community, relationships, and networks—to discern opportunities to work with a community or in a place, relative to other areas within the geography (see Chazdon and Lott 2015).

To understand social capacity in a place, the community asset mapping process includes visualizing how networks of people and organizations interact and are spatially distributed. Initial mapping may include existing spatial data, such as the boundaries of communities, towns, or where organizations currently work. This may also involve identifying key actors (individuals or organizations) and important relationships and networks related to sagebrush conservation (e.g., “Who do you go to for what?”; Guerrero et al. 2015b).

RFPAs and other local landowner associations are an example of individuals self-organizing around an issue that intersects with their livelihoods (Abrams et al. 2017). It may be useful to map spatial extent and member interactions as well as information on external organizations they engage with and under what circumstances. Information on the latter would begin to further refine willingness to act, especially around a resonant issue (“What mobilizes people here?”), further refining the nature of social capacity in an area and relative to other places in a geography. Again, while this information may be associated with a specific place—refining the group’s understanding the extent of the community or relationships spatially—it is necessarily qualitative, characterizing relationships and networks within that place (Chazdon and Lott 2015).

The Prineville LIT was asked to reflect on the presence, types, and qualities of relationships within areas where conducive administrative conditions and ecological importance overlapped. Facilitators asked guiding questions such as: What issues have LIT members found brings people together (e.g., attend meetings or engage with agency staff) in this area? Where—either spatially or surrounding a specific issue—have they historically had a lot

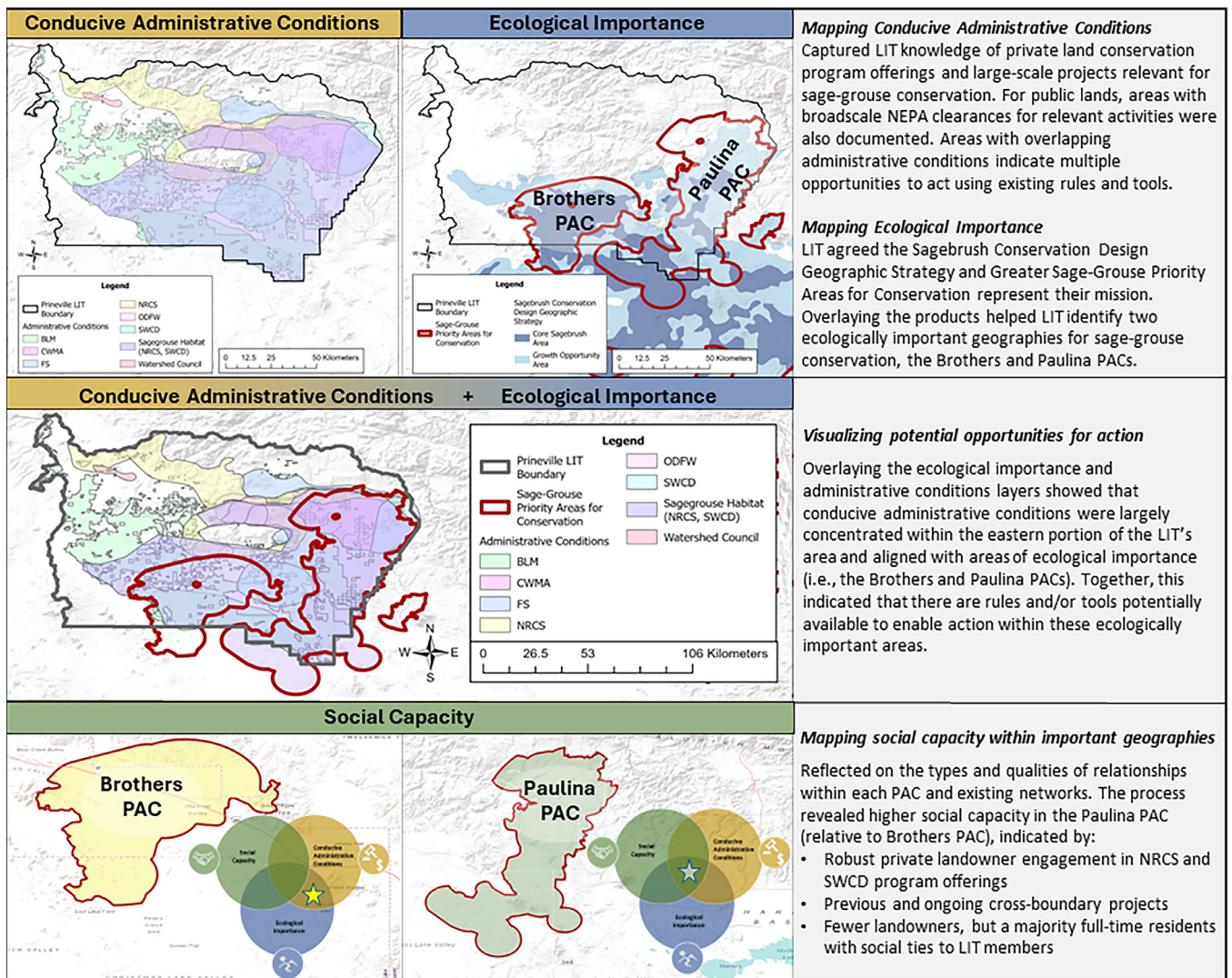


Figure 2. The Prineville Local Implementation Team (LIT) applied the Conservation Readiness Framework to 1.2 million ha LIT area to identify a geography ready for strategic conservation. In a facilitated process, the multistakeholder group mapped conducive administrative conditions and ecological importance. They next assessed social capacity where ecological importance and conducive administrative conditions aligned, comparing relationships and networks (i.e., reflecting on conditions for working together) between the Paulina and Brothers PACs. The group determined the Paulina PAC was immediately ripe for strategic conservation, while social capacity will need to be further developed in the Brothers PAC. BLM indicates Prineville Bureau of Land Management; CWMA, Crook County Weed Management Area; FS, Forest Service; NRCS, Crook County Natural Resource Conservation Service; ODFW, Oregon Department of Fish and Wildlife; SWCD, Crook Soil and Water Conservation District.

of landowner participation? Where are key leaders located to tap into community networks? Given the qualitative nature of the information gathered, relative social capacity was assessed by comparing reflections from these questions between two options identified for future work based on ecological importance and administrative conditions (i.e., the Brothers and Paulina PACs; Fig. 2).

Lastly, a limitation of using history and/or presence of relationships—particularly between rangeland property owners and agency staff—as an indicator of social capacity in a place is that it reinforces inequities by privileging the individuals, identities, and communities who have received resources and support in the past and underrepresents those that have not (Van Sant et al. 2021). There are several historical as well as logistical reasons some communities have been underserved or choose to not associate with governmental entities. It is important in the diagnostic application of this framework to critically reflect on the capacity-building needs of diverse and marginalized communities (which will be different from those traditionally served) so as not to continue to

benefit the same places that have always benefitted and further exacerbate environmental injustices (Calo 2020).

Integrating the components of conservation readiness

The components are interactive and context-dependent. Working in areas of ecological importance is foundational to conserving the sagebrush biome (Boyd et al. this issue), but without consideration of either social capacity or administrative conditions it is unlikely that conservation activities can be implemented or that they will translate to meaningful outcomes at larger spatial and temporal scales. For instance, “random acts of conservation” (Fig. 1B) might occur when an organization has funding for conservation practices, but weak relationships with landowners in ecologically important areas (i.e., conducive administrative conditions to work in ecologically important areas but low social capacity). Likewise, organizations with resources might direct conservation resources where they have relationships with landowners in an area that ultimately may be of little value in combating ecological threats (i.e.,

conducive administrative conditions and high social capacity in areas of limited ecological importance; Fig. 1B).

A deficit or mismatch in administrative conditions and areas of ecological importance also limits strategic conservation, even when social capacity is present. For example, BLM Resource Management Plans for greater sage-grouse restricted the use of prescribed fire to counter western juniper (*Juniperus occidentalis*) encroachment within sage-grouse habitat on BLM lands (Boyd et al. 2017). Even if there is social capacity—defined, in part, by landowner and land manager willingness to use prescribed fire on surrounding conifer-encroached landscapes where sage-grouse habitat cooccurs with ecologically important rangelands—administrative conditions functionally limit use of the tool across multiple landownerships in these areas (Brunson 2023). Because conifer expansion is one of the leading threats in the sagebrush biome (Doherty et al. 2022), the exclusion of prescribed fire to address the threat has biome-wide consequences, particularly given that prescribed fire treatments have roughly twice the treatment lifetime of mechanical alternatives (Davies et al. 2019) and higher treatment cost of mechanical alternatives limit the impacts of their application (Boyd et al. 2017).

Further, conducive administrative conditions and social capacity are mutually reinforcing. A lack of administrative tools, such as funding and technical resources, can negatively affect social capacity. In a study of voluntary sage-grouse conservation among ranchers in southeastern Oregon, Wollstein and Davis (2017) found willingness to participate was most influenced by availability of resources to enact conservation practices (administrative conditions) and alignment of those practices with ranchers' values (social capacity). To enhance the latter, social relationships between ranching communities and external organizations may help build social capacity to create conservation readiness. Administrative rules have also been documented to enhance social capacity. As the US Fish and Wildlife Service developed Candidate Conservation Agreements with Assurances to increase voluntary sage-grouse conservation, rancher subscription was initially limited due to concerns about privacy and sharing information with the federal government. To address this condition limiting rancher willingness to participate in conservation (social capacity), Oregon Revised Statute 192.501, an administrative rule, was enacted to provide assurances of privacy (Wollstein and Davis 2020).

Applying the Conservation Readiness Framework

The Conservation Readiness Framework can be practically applied at local, midlevel, and regional governance levels by organizations, partnerships, or multistakeholder coalitions to identify areas of conservation readiness (see Fig. 2 for an example from a midlevel group). We refer to governance levels at local, mid, and regional geographic scales, recognizing that they are ecologically connected (e.g., local-level dynamics influence regional ones) and include multiple jurisdictional scales (Folke et al. 2005; Cash et al. 2006). Each level has different and, ideally, complementary roles; different sets of actors perform those roles with an eye to how their actions influence other scales (Fig. 3). Regardless of the level at which the framework is applied, it is important to acknowledge the need for coordination capacity in these arrangements, that is, individuals/organizations whose explicit roles include coordinating and supporting groups in undertaking a process using the Conservation Readiness framework (see also Wollstein and Johnson 2023).

Below we describe how the Conservation Readiness Framework can be used by groups, such as the Prineville LIT, to take stock of their assets and identify opportunities and also reflect on barriers to conservation readiness in ecologically important areas. The framework may be applied to distinguish roles and strate-

gies of actors residing at different governance levels to address these needs, in addition to the short- and long-term activities that will ensure strategic conservation may be sustainably pursued over time.

Assessing conservation readiness: Inventorying assets

Inventorying assets allows users of the Conservation Readiness Framework to pragmatically reflect on action that is currently possible within areas of ecological importance under current social and administrative conditions. Areas immediately ready for strategic conservation reside in the overlap between ecologically important areas with social capacity and administrative conditions conducive for enacting strategic conservation (Fig. 1B).

Identifying geographies where ecological importance aligns with social capacity and conducive administrative conditions creates a heatmap of areas of conservation readiness. Here, midlevel groups may readily identify areas where action could be immediately possible. They also have the ability to weigh such opportunities relative to one another, a foundational principle of strategic conservation. For example, the Prineville LIT found conducive administrative conditions aligned with two areas of ecological importance, the Brothers and Paulina PACs (Fig. 2). Upon assessing relative social capacity (i.e., comparing their knowledge of relationships and opportunities between the two PACs), the Prineville LIT determined the Paulina PAC was immediately ready for strategic conservation and that they would focus near-term efforts in that geography.

Assessing potential for conservation readiness: Diagnosing needs

After inventorying assets, the Conservation Readiness Framework helps groups identify “where” in their geography components may be missing or anemic, preventing them from being strategic with their resources and efforts. For ecologically important areas not yet ripe, what are the barriers? How readily can these barriers be negotiated? What investments will be required and over what timeframe? What is needed to maintain conservation readiness over time? Reflecting on these questions may help groups discern priorities regarding where and what components must be developed, or whether developing these components is worth the opportunity cost of not using limited resources in areas where components already exist (e.g., Van Lanen et al. 2023). Furthermore, groups must critically reflect on reasons why social capacity may be perceived as low or underrepresented when assessing conservation readiness, especially where communities have been marginalized or underrepresented in the conservation arena. This diagnostic application of the framework offers an opportunity to seek multiple forms of equity by building capacity for diverse and also marginalized communities so they become areas of conservation readiness in the future (Eaton et al. 2022).

When social capacity is lacking in areas of ecological importance, midlevel groups might reflect on the types of activities to invest in to start to build social capacity. In general, this work involves relationship building, although in historically underserved communities (that may appear to have low social capacity) this will also require addressing conditions that have created or reinforced inequities. Klein et al. (2015) refer to contextual factors, including structural, cultural, and functional aspects of a social system that influence conservation equity; seeking to understand these in addition to existing networks, ways of organizing, and community preferences for how they are engaged and how they are involved in decision making is an important aspect of identifying longer term actions (Eaton et al. 2022). These considerations will offer insights as to how to build external connections and the types of assets that will enhance them and make them credible, ul-

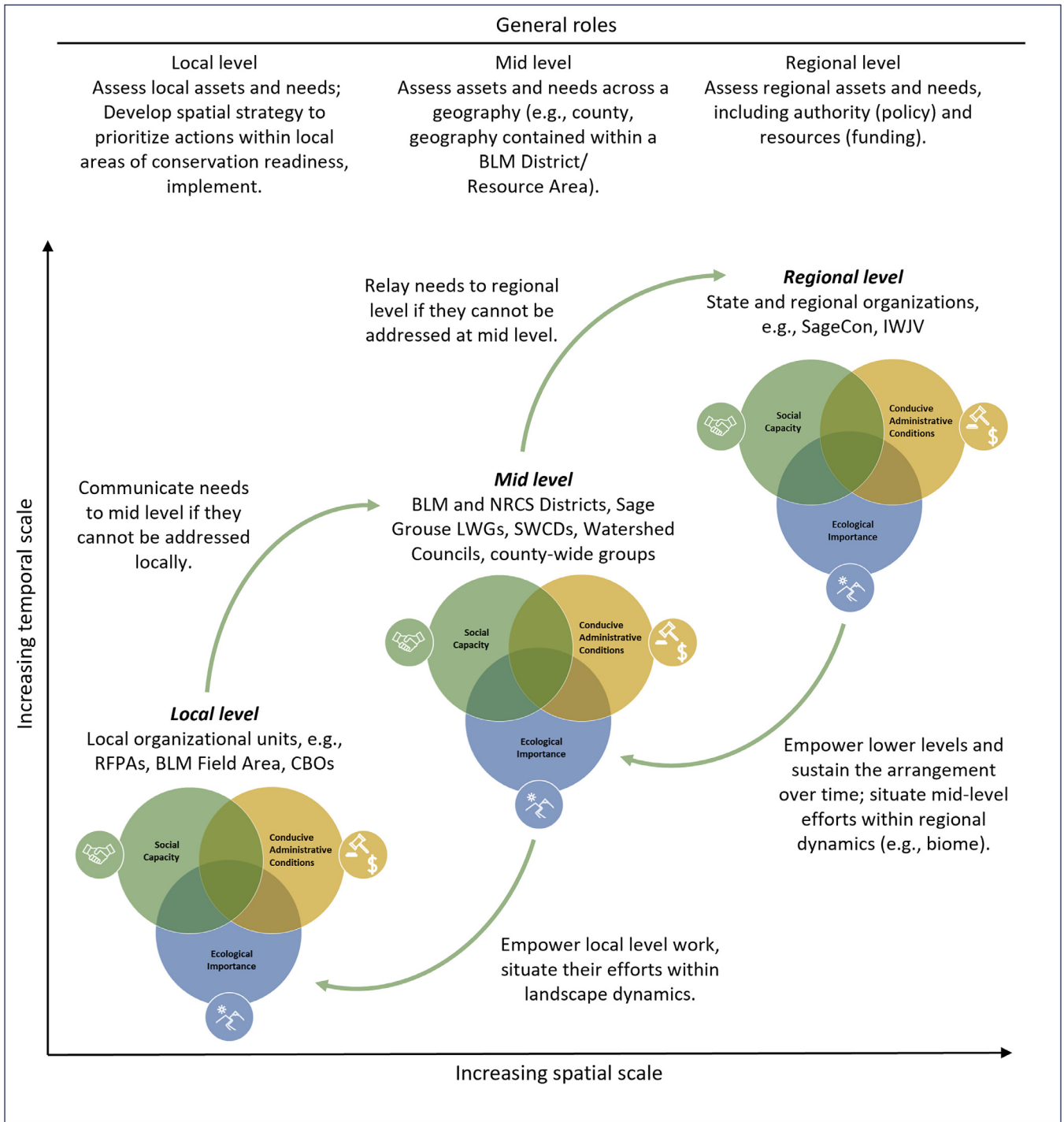


Figure 3. Actors and roles within different levels of the multilevel Conservation Readiness Framework to support strategic conservation. RFPAs indicate Rangeland Fire Protection Associations, BLM, Bureau of Land Management, CBOs, community-based organizations; NRCS, Natural Resource Conservation Service; LWGs, Local Working Groups; SWCDs, Soil and Water Conservation Districts; SageCon, SageCon Partnership; IWJV, Intermountain West Joint Venture.

timately affecting the ability to achieve the conservation outcome (Klein et al. 2015). It may require simply sharing information between individuals or external partners and a community, or engaging in processes that require more time, resources, and trust-building.

For the Prineville LIT, building social capacity in the Brothers PAC will partially require a strategy for engaging absentee landowners. Conducive administrative conditions are also helpful; program offerings aligned with individuals' or a community's val-

ues can increase the perception that there is a benefit to engaging (Hauptfeld et al. 2022).

In instances in which administrative conditions and social capacity enable action outside of areas of ecological importance (i.e., see “random acts of conservation” in Fig. 1B), groups may focus on securing small wins to build competencies and hone collaborative capacities (Arispe et al. 2023). But it is imperative that such groups next turn their attention to work within the realm of ecological importance and apply these competencies (Fig. 1B).

Table 1
Summary of applications of the Conservation Readiness Framework and indicators/considerations for each application.

Framework application	Description	Indicators and considerations
Inventorizing assets	<i>What action is currently possible?</i> Assess conservation readiness across a geography or in a local geography, identifying opportunities ripe for strategic conservation at the local-level.	Ecological importance, social capacity, and conducive administrative conditions are present.
Diagnosing needs	<i>What do we need for action to be possible?</i> Assess barriers to implementing strategic conservation across a geography or in a specific location (mid and local-levels, respectively)	What social capacity and/or administrative conditions are minimal or lacking within ecologically important areas (e.g., CSAs)?
Creating/supporting conservation readiness across scales	Identify activities (actors, roles, resources) necessary at each governance level to address diagnosed needs	At what levels must social capacity and/or administrative conditions be addressed? What activities at these levels will ripen opportunities?
Creating/supporting conservation readiness across time	Identify activities (short- and long-term) necessary at each governance level to sustain the arrangement over time	To address needs in social capacity and/or administrative conditions, what is the timeframe for undertaking activities that will ripen opportunities?

Creating or supporting conservation readiness across scales

Addressing biome-wide challenges requires multiple actors coordinating their actions across multiple scales (spatial/geographic, temporal, and jurisdictional). Operationalizing strategic conservation must include the strategic selection of actions and intentional consideration of what actors undertake these actions and at what levels. Accordingly, the Conservation Readiness Framework has applications at different levels with implications for multiple scales (Fig. 3).

The local-level is where conservation is implemented. This geographic area may be centered around a community affected by a focusing event, such as wildfire, or might be defined by existing organizational units to address resource management issues (e.g., RFPAs). The framework would have salience in participants' local areas, where the needs might point to specific places, people to engage, or duties to be performed. Community-based groups are known to effectively develop shared priorities, spatial strategies, and tactics when they have resources and discretion to act (Belton and Jackson-Smith 2010; see Wollstein et al. 2022 for example). At this level, ground truthing opportunities, gathering pertinent data, and engaging relevant actors is particularly important. Barriers identified during the asset-based mapping process such as limiting administrative conditions (e.g., NEPA clearance for proposed actions in specific places at the local-level) may be better addressed at mid- or regional levels; local-levels might relay these needs (Fig. 3).

Midlevels may be comprised of organizations and collaborators that cover larger geographies, such as BLM Districts, county organizations, Watershed Councils, and Sage-Grouse Local Working Groups (e.g., Griffin 1999, Belton and Jackson-Smith 2010, Wollstein and Johnson 2023). These units occupy larger spatial scales and can apply the framework to inventory and weigh opportunities within their areas to enable or support local-level action, procure resources for local-levels (e.g., provide grant writing support) and, if membership includes governmental actors, clarify and/or interpret policies to potentially refine conducive administrative conditions, such as authority and resources to act (e.g., Wollstein and Davis 2020; Fig. 3).

Regional levels might include state and federal agency offices and statewide or regional organizations, such as the SageCon Partnership in Oregon. Overarching plans to address ecosystem or biome threats can “see” the big picture at these larger spatial and temporal scales (Fig. 3). While regional levels might attend to policy, resource, and legislation needs communicated by midlevels, it is difficult for plans and actions to entirely account for the likely variation in local-level assets and needs (Marshall 2008).

Thus, for local-level actions to meaningfully address larger-scale dynamics, the midlevel has an outsized role in bridging regional and local-levels by situating local-level efforts within the bigger

picture and communicating needs to create and support conservation readiness across scales (Cash et al. 2006; Marshall 2008; Wyborn and Bixler 2013; Fig. 3). Midlevels might benefit most from applying the framework to inventory assets and use these to prioritize and situate strategic conservation opportunities on a large landscape (Table 1), while local-levels experiencing difficulty acting or making progress might benefit from using the framework diagnostically.

Creating or supporting conservation readiness over time

The Conservation Readiness Framework uses an asset-based mindset, asking users to consider current opportunities within the three domains before examining what would need to change for conditions to become ripe for strategic conservation. “Ripening” conditions particularly necessitates discerning between short-term and long-term activities that will create or support conservation readiness over time. Conservation readiness isn't static and needs change over time. The framework calls users to reflect on how needs may change over time. How durable is conservation readiness in a place? Will current efforts be able to be sustained over time? What types of investments will sustain it?

Short-term activities will naturally be oriented toward the important, urgent activities that can be undertaken with current assets. If some relationships are already in place, they will require maintenance. If some NEPA analysis has been completed, what authorized treatments or practices can be applied within the realm of ecological importance? Doing both this social and administrative work in the short-term will also illuminate needs or future conditions that must be created (see Arispe et al. 2023).

Creating social capacity, in particular, usually requires long-term investments. These might include building social capital, shifting agency culture, and addressing coordination capacity needs so efforts are durable. What needs to change about existing conditions to truly engage in collective actions? This likely requires a transformation in how individuals and organizations work together, as well as a reconceptualization of success, especially given progress in social capacity doesn't necessarily yield immediate or clearly quantifiable outcomes (Thomsen and Caplow 2017).

Management implications

Perhaps the most important consideration in implementing strategic conservation is that it is not an “event” that is reactively precipitated by circumstance (e.g., wildfire). It is instead a deliberate process that adaptively unfolds over time and attends to not only the ecological dimensions of conservation, but also the social and administrative ones. Without holistically considering the three components of conservation readiness, we risk working in either ecologically important areas with little effect because there are

seemingly irreconcilable social and institutional barriers to conservation action, or in places where there may be enthusiastic partners skilled at securing funding but not necessarily targeting activities in the realm of ecological importance.

The Conservation Readiness Framework we present for evaluating conservation readiness can be used across governance levels to understand the convergence of enabling social, administrative, and ecological conditions and promote effective, strategic, and durable conservation. Rather than being an impenetrable barrier to acting when one or more conditions are absent, this approach can inform capacity-building measures that may remedy the situation. Spatially mapping the extent of social, administrative, and ecological conditions within an area of management influence can illustrate the most efficacious scale of conservation actions and reveal conditions that need to be maintained or created to enable such actions, which in turn helps to determine the roles, responsibilities, and strategic activities of biome, mid, and local-level entities.

Importantly, securing the elements of conservation readiness will require intentional institutional change at multiple levels (Clement et al. 2015). This involves examining preconceived ideas matching circumstance and response. A good example would be reactively implementing a largely static and predetermined set of management practices in response to wildfire (Boyd et al. [this issue](#)), particularly when such measures do not coincide with the convergence of “ripe” social, administrative, and ecological conditions. Such actions may not only be of questionable efficacy due to their reactive application in dynamic rangeland environments, but they also impose an opportunity cost by limiting resources available to expend on strategically determined projects where success may be more likely and of greater impact (e.g., Van Lanen et al. 2023).

Similarly, institutional change also involves expanding the notion of “shovel ready” projects, a term that in practice is often used to prioritize conservation activities in areas of a landscape where two of the three required conditions for strategic conservation are secured (e.g., ecological and administrative conditions, or social and administrative conditions). Administrative conditions may indeed empower project implementation at local scales, but the durability of those actions will suffer if social capacity is not present, and the ultimate impact of such efforts will be questionable in the absence of ecological relevance. By the same token, a focus on delineating ecological importance (the focus of most of this special issue) while not recognizing where enabling social and administrative conditions exist or must be cultivated is not likely to result in conservation outcomes necessary to abate major contemporaneous threats to the sagebrush biome.

Lastly, underlying this process is the imperative of thought, and that thought process begins with a scale-dependent hierarchy of action that defines critical roles and responsibilities (see [Fig. 3](#)). Open decision space entities (see [Doherty et al. this issue](#)) are concerned with regional to biome-level prioritization of effort and resources. Within defined decision spaces ([Doherty et al. this issue](#)), midlevel organizations focus on targeting and empowering conservation actions within scales from multiple watersheds to extensive landscapes, whereas local-level entities work to identify, understand, communicate needs, and overcome barriers to planning and implementing projects.

Conclusions

The goals of this article were to illustrate that: 1) social capacity, conducive administrative conditions, and ecological importance are all necessary for strategic and durable conservation, 2) these three components comprise a multilevel framework for assessing and mapping conservation readiness, 3) mapping and as-

sessing these components can help direct the nature of roles and activities needed for effective conservation, and, lastly, 4) these roles and activities vary across biome, regional, mid, and local scales.

The SCD offers a valuable framework for informing where conservation efforts should be focused in the sagebrush biome. However, the fact that CSAs have been identified for conservation priority does not necessarily indicate presence of the social and administrative conditions that enable strategic, coordinated, and durable actions that will effectively defend or grow CSAs. Put another way, ecological importance as informed by the SCD tells us where we *need* to work. The addition of social and administrative conditions tells us where we *can* work. Thus, the multilevel asset-based Conservation Readiness Framework brings to bear social and administrative components on areas of ecological importance; it emphasizes relationships and interactions between ecological, social, and administrative domains of conservation, as well as the short- and long-term work that will be necessary for addressing threats to the sagebrush biome identified in the SCD.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests.

CRediT authorship contribution statement

Katherine Wollstein: Conceptualization, Data curation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review & editing.

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