Barriers and opportunities for cooperative wetland management: a case study in the greater Rocky Mountain National Park ecosystem

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Abstract The boundaries of most protected areas are not large enough to encompass natural processes such as hydrologic and ecological connections between wetlands and within watersheds. Therefore, management is likely to be improved by working across boundaries with multiple jurisdictions. This research explores barriers and opportunities for cross-boundary cooperation for wetland stewardship in Rocky Mountain National Park (RMNP), Colorado, USA, and surrounding areas, using semi-structured interviews with staff members of government agencies, non-profits, research organizations, and municipalities. Results show that wetlands outside of RMNP are experiencing similar cross-boundary disturbances to those within the park. Although participants recognize that working cooperatively with neighboring jurisdictions can decrease the effects of boundaries on wetland integrity, they also reported that the most significant cross-boundary challenge is working with others to exchange resources, develop a common goal, and implement projects cooperatively. We provide recommendations on how to address cooperative management challenges while taking advantage of opportunities to facilitate cross-boundary wetland stewardship at the ecosystem-scale.

Keywords Cross-boundary stewardship · Landscape-scale management · Partnership · Protected area · Resilience · Wetland integrity

Introduction

The boundaries of most protected areas are not large enough to encompass natural processes. Therefore, connections with adjacent lands are essential for sustaining the ecological system of protected areas (Davis and Hansen 2011). In addition, scenic or recreational values were often considered over natural processes when delineating the boundaries of most U.S. protected areas, including national parks (Pressey 1994; Davis and Hansen 2011). Natural processes, such as hydrologic and ecological connections that shape wetlands, often expand beyond the boundaries national parks and other protected areas (Nel et al. 2007; Davis and Hansen 2011). As the distribution of species and flow of ecological systems shift in response to climate change, understanding connections between protected areas and surrounding lands becomes critical (Parmesan and Yohe 2003). In recent decades, several factors, including threats from climate change, have increased the interest in interactions between protected areas and adjacent lands (Hansen et al. 2011), leading natural resource managers to utilize stewardship at larger scales that...
involves working across boundaries with multiple jurisdictions (Johnson et al. 1999; Kingsford 2011; Scarlett and McKinney 2016; Floress et al. 2018). Cross-boundary stewardship is necessary for many different types of resources, including forest and fire management (Bergmann and Bliss 2004; Kirkland and Charnley 2021), wildlife (Forbes and Theberge 1996), and water resources (Rickenbach and Reed 2002).

Cross-boundary stewardship requires coordinated behavior between actors to address complex management issues (Tait and Brunson 2021). A management issue of growing complexity and concern is the resilience and integrity of wetland ecosystems (Millennium Ecosystem Assessment 2005). While the ecosystem services delivered by wetlands are diverse and widely recognized (Sutula et al. 2006; Mitsch et al. 2015; Schweiger et al. 2019), wetlands are often severely fragmented and receive insufficient protection. Water for wetlands in the western United States is not guaranteed due to laws that give priority to water rights holders based on date the water was put into use (Downard et al. 2014; Frank et al. 2016). These water rights holders are allowed to build infrastructure that diverts, extracts or moves water from its source to where it will be put into use. Since streams and aquifers are often the source of a wetland’s water supply, its integrity depends on how water rights are allocated and the diversions put in place by water rights holders (Welsh et al. 2013; Downard et al. 2014). Cross-boundary stewardship between managing agencies and water rights holders is often required to restore or maintain wetland connectivity since the scale required for connectivity often exceeds the boundaries of individual governance (Bergsten et al. 2014; Kininmonth et al. 2015).

Along with connectivity between wetlands, many disturbances effecting wetland integrity occur beyond jurisdictional boundaries of managing entities, requiring cross-boundary stewardship. Protected area systems focused on wetlands, such as the U.S. National Wildlife Refuge System, cite cross-boundary stewardship as an important mechanism to address disturbances that cross protected-area boundaries, including climate change (Griffith et al. 2009). Due to the long-lasting effects from disturbances like climate change, utilizing partnerships and collaborations to meet wetland conservation goals will continue to become even more important (Griffith et al. 2009). Despite the urgency for cross-boundary stewardship of wetlands, few studies have been conducted on cooperative wetland management from a social perspective (Olsson et al. 2004; Kininmonth et al. 2015; Bataille et al. 2021), more specifically management of montane wetlands (Daniel et al. 2013), especially collaboration between federal agencies such as the National Park Service and other stakeholders. Large-landscape management strategies have been implemented for wetland systems such as the Florida Everglades (Fitz et al. 2004), Chesapeake Bay (Hassett et al. 2005), and Prairie Pothole Region (Gleason et al. 2011), but these tend to be top-down, agency-dominated efforts that span across multiple states (Murry 2019). This research focuses on a bottom-up, grassroots-initiated effort designed to address specific wetland management challenges at a local landscape level.

In this article, we provide an overview of cooperative management and present a case study in the greater Rocky Mountain National Park ecosystem through which barriers and opportunities to achieving cooperative management for wetland integrity and resilience are identified. Additionally, recommendations are provided to overcome these barriers while taking advantage of opportunities to achieve cooperative efforts that account for wetland resilience while acknowledging the differing missions and goals of land management entities that share stewardship responsibility of those wetlands.

**Theoretical framework**

Cooperation refers to the sharing of rights and responsibilities between individuals to obtain joint benefits (Plummer and FitzGibbon 2004; Tait and Brunson 2021). Cooperation can viewed as a spectrum of interactions that include being aware of others’ activities and goals, discussing objectives and actions, supporting the goals of other entities through activities, and actively sharing work and resources between entities to achieve mutual goals (Yaffee 1998). Multiple interactions along the spectrum, implemented at different scales are often necessary for effective cooperative management of natural resources (Yaffee 1998; Mandell and Steelman 2003; McNamara 2012). For some problems, effective cooperation may come from the interactions of a scientist and manager within a single unit or a single
agencies. For other situations, complex, multiparty structures may be appropriate.

Within each type of cooperative interaction exists a series of forces that either promote or restrain the success of the interaction between groups (Yaffee 1998). For the purposes of this research, the forces that retrain the cooperative interaction and encourage entities to work on their own will be viewed as barriers to cooperation. The forces encourage entities to work together and promote the cooperative interaction will be viewed as opportunities for cooperation or ways to overcome barriers and facilitate cooperative interactions. The success of cooperative efforts depends on whether the opportunities outweigh the barriers (Yaffee 1998).

With some notable exceptions (e.g., Yaffee 1998; Bothwell 2019; Floress et al. 2018), much of what has been written about cross-boundary cooperation has not been drawn from empirical data focused on cooperation between multiple public jurisdictions, but rather cooperation amongst private landowners (Finley et al. 2006; Yung and Belsky 2007) or between the private landowners and public land management entities (Fischer and Charnley 2012; Ferranto et al. 2013; Fischer et al. 2019). In response to the growing body of literature on cross-boundary cooperation and the small number of empirical studies on multi-jurisdictional arrangements, especially for the management of wetland resources, this research aims to add perspectives from state and federal agencies, research organizations, municipalities, and nonprofits.

The greater Rocky Mountain National Park ecosystem

Rocky Mountain National Park (RMNP) is a ~415,000-acre protected area that is located along the Continental Divide in north-central Colorado (NPS 2013). The majority of the park is designated wilderness with its diverse topography and wide range of elevation resulting in high ecological diversity. In contrast, the largest urban area in the Rocky Mountain region is located only a few miles away. The park shares its borders with three national forests administered by the USDA National Forest Service: Arapaho, Roosevelt, and Routt; the cities of Grand Lake and Estes Park; and private, state, and county land. Several river systems originate in the park, including the Colorado and the Cache la Poudre (Schweiger et al. 2019). RMNP is also comprised of a matrix of watersheds, many of which extend beyond the park’s boundaries. Watersheds on the east and west sides of the park, which would be naturally separated by the Continental Divide, are connected by water diversion structures.

In RMNP, wetlands support a majority of the biodiversity but only make up a small portion of the park (Schweiger et al. 2019). Wetlands in RMNP encompass a wide variety of types and provide numerous important ecological functions (Naiman et al. 1993; Cooper and Sanderson 1997; Mitsch and Gosselink 2007). Long-term monitoring by National Park Service’s Rocky Mountain Inventory and Monitoring Network found that approximately half of the area classified as wetland are degraded due to anthropogenic disturbances (Stoddard et al. 2006; Schweiger et al. 2016), which often occur beyond park boundaries. Since the late 1800s, wetland integrity in RMNP has been heavily influenced by human-induced changes in hydrology, removal of predators, and introduction of species (Schweiger et al. 2019). Many of these impacts extend beyond the boundaries of the park into other agency and municipal jurisdictions.

Disturbances beyond RMNP’s boundaries influence wetland integrity because, like most protected areas, the park is part of a larger ecological system in which ecological connections and processes extend into multiple jurisdictions. Therefore, protecting wetland integrity requires management across boundaries. Management across larger scales can be achieved by identifying “greater ecosystems,” areas surrounding protected areas, such as national parks, in which ecological connections are present (e.g., The Greater Yellowstone Ecosystem). The ecological and hydrologic processes that support wetlands within RMNP extend beyond the park’s jurisdictional boundaries requiring management of wetlands and their supporting systems at larger scales involving multiple entities (Tait and Brunson 2021). Cross-boundary stewardship can be used to involve multiple entities for more effective wetland conservation. The entities that share responsibility for wetland stewardship often have differing missions and goals. Cross-boundary stewardship can also be used to acknowledge these differences and work towards the common goal of wetland sustainability. In this study, the area surrounding RMNP in which ecological and hydrologic
connections occur is referred to as the greater RMNP ecosystem (Fig. 1; Tait and Brunson 2021). The greater RMNP ecosystem includes entities that share borders with the park, as well as entities in the northern Front Range Urban Corridor, the populated region east of the mountain range that includes the cities of Fort Collins, Longmont, and Boulder. Several watershed and wetland coalitions operate on the Front Range. Each watershed coalition has a unique mission and different stakeholders, but all focus on river and riparian health. Along with watershed coalitions, many agencies and other organizations focus their efforts on wetland integrity throughout the region. This research explores challenges and opportunities for cross-boundary wetland management between entities in the greater RMNP ecosystem.

Fig. 1 Hydrologic connections between wetlands span many jurisdictional boundaries in the greater RMNP ecosystem including counties, cities, U.S. Forest Service, and National Park Service. Wetland data was downloaded from the U.S. Fish & Wildlife Service’s National Wetlands Inventory

Methodology

A qualitative research design characterized by semi-structured interviews and thematic analysis was used to determine barriers and opportunities for cooperative management within the case study. Interviews consisted of 22 open-ended questions that inquired about the effects of jurisdictional boundaries on wetland ecological processes and conditions, barriers to cooperative wetland management, and the institutional and social contexts in which cross-boundary stewardship efforts operate. Selected questions from the interview protocol are shown in (Table 1) as examples of pertinent topics that were asked about during each interview. A total of 22 interviews were conducted in person or via telephone from July to October 2019.
with representatives from federal and state agencies, wetland research organizations, county municipalities, and non-profit organizations in the greater RMNP ecosystem (Table 2). Participants from each agency and organization consisted of administrators, field practitioners, and wetland specialists to obtain viewpoints that represented all levels of wetland stewardship. The selection of interviewees was based on purposive sampling of participants that work directly on wetland management within the study area (Creswell 2013). In addition, snowball sampling was used, in which interviewees identified others with knowledge or experience related to the study questions (Biernacki and Waldorf 1981). Only those identified that work in wetland stewardship within the greater RMNP ecosystem were included as participants in the study. Interviews were conducted until saturation was reached, meaning no new information was communicated by the participants (Rudestam and Newton 2015). With the consent of interviewees, the interviews were tape-recorded, and notes taken. Interview duration ranged from 30 to 75 min. Interviews and field notes were transcribed verbatim.

Data analysis involved generating themes from the data by using a systematic, iterative process of coding in ATLAS.ti, a qualitative analysis computer software program (Hwang 2008; Creswell 2013; Miles et al. 2019). This technique utilized an inductive data analysis process that built codes, categories, and themes by organizing data from multiple sources into increasingly abstract units of information. Transcripts were read, and memos (short phrases, ideas, or key concepts) were written to start the initial process of exploring the data. Next, data were interpreted through the formation of codes which are labels attached to units of data that assign symbolic meaning. During the

Table 1  Selected questions from interview protocol

| Interview question                                                                 | Data                                                                 |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Do conditions across a boundary from the wetlands you manage ever influence your  | Cross-boundary influences on wetland integrity                       |
| management objectives or activities on property under your jurisdiction? How?     | Cross-boundary influences on wetland integrity                       |
| What sort of future changes do you anticipate that could influence your ability to| Cross-boundary influences on wetland integrity                       |
| achieve wetland stewardship goals across boundaries?                              | Cross-boundary influences on wetland integrity                       |
| What do you see as the significant cross-boundary challenges that you face in     | Cross-boundary influences on wetland integrity; Barriers             |
| regard to wetland stewardship, and why do you think so?                            | Opportunities                                                        |
| What do you see as the biggest barriers to achieving cross-boundary collaboration  | Opportunities                                                        |
| or management of cross-boundary wetland resources?                                |                                                                     |
| How are you addressing these challenges (recognizing that you may not be able to   |                                                                     |
| address all of them)?                                                             |                                                                     |
| How does the partnership define success or failure of its efforts? How were these  | Opportunities                                                        |
| criteria selected (e.g., through group discussion, or defined by statute/regulation)? |                                                                   |
| What do you see as the biggest barriers to achieving cross-boundary collaboration  |                                                                     |
| or management of cross-boundary wetland resources?                                | Opportunities                                                        |

Table 2  Participant profile

| Entity-type      | Number of interviews conducted | Gender | Years in current position (mean) |
|------------------|-------------------------------|--------|----------------------------------|
|                  |                               | Male   | Female                          |                                  |
| Federal agency   | 9                             | 4      | 5                                | 6                                |
| Nonprofit        | 7                             | 5      | 3                                | 10                               |
| State agency     | 2                             | 1      | 1                                | 13                               |
| Research         | 2                             | 1      | 1                                | 14                               |
| County municipality | 2                           | 1      | 1                                | 9                                |
first round of coding, codes were created to identify sections of each transcript in which a general topic of interest was discussed, such as barriers and opportunities to cooperation and cross-boundary influence on wetland integrity. In the second round of coding, the general topics were distilled into categories and themes to identify commonalities across all transcripts. To ensure consistency and accuracy during the analysis of each transcript, definitions of codes, categories, and themes were created and recorded. After themes were created, they were organized using matrices to help conceptualize and represent the main findings of the study.

Results

Main themes identified from analysis of interview transcripts are described below, including counts of the number of interview participants that described each theme. Quotes are presented to provide context and detail for each theme. Each quote was selected based on its representative nature of the views of all participants who described that theme during their interview.

Cross-boundary influences on wetland integrity

To better understand how wetlands in other jurisdictions are affected by cross-boundary disturbances, we asked participants how conditions across boundaries influence the wetlands they steward. Every participant identified disturbances that cross jurisdictional boundaries, impacting the ecosystems they manage, including influences from different water uses and management practices, population growth, and climate change (Table 3). One participant identified the effects of water diversions on an area under their jurisdiction: “if you are allocating water or taking water out of a river upstream, it does influence the hydrology downstream and it affects wetlands.”

| Theme                                      | # of Interviews (n = 22) |
|--------------------------------------------|--------------------------|
| Different water uses and management practices| 15                       |
| Climate change                             | 11                       |
| Population growth and development           | 12                       |
| Challenges of working with others           | 22                       |

Different management practices between jurisdictions can also create ecological integrity concerns, as one participant described:

There’s a lot of fence-line contrast where management on one side of the fence is different from management on the other side. You can really see that in the vegetation, integrity of the soil, and ground surface.

Participants were also asked about future changes that could influence their ability to achieve wetland stewardship goals. Climate change and local population growth were identified as major influences on wetland stewardship, including how entities work together to address these issues, for example:

We are going to be facing increasing impacts of climate change and we know that wetlands are critical for keeping water on the landscape. We know that they are critical biodiversity hotspots. We know that there are a lot of legacy impacts to wetlands, as well as the ones happening right now. So, I feel like eventually we will wish we did more in terms of working together.

Participants are also concerned about the increased development that comes with a growing population. One participant describes the impacts of development on water resources,

Then as water resources become more regulated, which they are going to have to be because of all the growth...people are saying we need to build more reservoirs to store water when there’s an excess. Those kinds of changes in the way water rights are used could really have dramatic impacts on streams and wetland areas.

Participants identified a variety of cross-boundary influences on wetlands under their jurisdiction and anticipated future changes that could affect their ability to steward these ecosystems. Although participants recognized that working cooperatively with
neighboring jurisdictions can decrease the effects of boundaries on wetland integrity, they also reported that the most significant cross-boundary challenge is working with others.

Barriers to cooperation

Thematic analysis revealed five themes pertaining to barriers to cooperative management (Table 4). These include limitations to resources, divergent agency goals and missions, “silos” within organizations, public perceptions, and lack of a cooperative wetland program.

**Limited resources**

The barrier identified by all agencies and organizations was limited resources, including funding, staff, and time. Funding was cited as the biggest challenge, including limited funding within an entity and restrictions to sharing funding between entities. A participant stated that “sometimes funding is limited to one type of land ownership or another and that can get in the way of working across boundaries.” Participants stated that many federal and state management agencies have lost staff in recent years. This diminishes capacity to attend meetings, apply for funding, and work on projects. Staffing restrictions can also lead to local offices being closed, leaving large areas of the state without representation from an agency or organization. As one participant suggested,

It’s about having appropriate personnel in appropriate positions across a boundary…If there is no one covering whatever resource in a certain geographic area, there’s no one there to collaborate with.

**Differing goals and missions**

Another barrier is differing goals and missions between agencies or organizations. Goals and missions often differ in scope, or the extent of subject matter that is relevant to a specific entity. For example, one land management agency may have a dual mandate, to protect natural resources and provide recreation, while another may have a multi-use mandate. One participant described differences in scope between missions this way:

We are more focused on ecosystem-level restoration, whereas sometimes you have an organization that might be more singularly focused on wildlife or more singularly focused on even certain species of wildlife.

Goals and missions can also differ in geographic scale. Fulfilling the mission of some organizations requires work across an entire state or region, while the mission of another organization may only require work in one watershed or along one river corridor.

These differing missions can lead to different ways of approaching management, as one participant explained. “I would say it isn’t usually the end goal that is so different, it’s the methodology on how to get there and the perspective that is brought.” To work cooperatively, entities must understand each other’s mission and work to find a mutual end goal.

**Organizational silos**

The development of organizational silos, or the mindset that you must adhere strictly to the duties within your department or organization, is a barrier to working cooperatively. One participant described this challenge:

It’s that siloization of each of the organizations. [They] have their own set of rules and regulations and the challenges are those organizations busting out of those and trying to do something that could help the stream or wetland across boundaries.

**Table 4  Barriers to cooperation**

| Theme                        | # of Interview (n = 22) |
|------------------------------|-------------------------|
| Limited resources            | 22                      |
| Differing goals and missions | 17                      |
| Organizational silos         | 7                       |
| Public perception            | 4                       |
| Lack of cooperative program  | 2                       |
Silos often form in larger agencies and organizations that have hierarchical structures, as one participant describes, “You know the hierarchy when you get up to the federal government, there tends to be sort of more rigidity in what they can and can’t do.” Another participant further described this challenge, “These public land management agencies, they don’t have a lot of incentive from their superiors to look across boundaries. They don’t have a lot of experience or don’t expose folks coming through their training [to cross-boundary management]. They get into these positions and then there’s a lot of anxiety and fear of doing things differently.

This also leads to barriers for employees that want to work cooperatively with other entities, but don’t have agency support. As one participant observed, “if they don’t have the support of their organization, a lot of times they might want to do something but might not really be able to.”

Public perception

All challenges to cooperation described thus far were identified by participants across all types of entities studied, including federal and state agencies, counties, and non-profits. A barrier unique to federal agencies and county municipalities in this study is public perception. These entities have a responsibility to serve public interests, which creates additional considerations when making cooperative management decisions. One participant described the challenges to implementing new management practices:

We’ve definitely gotten inquiries about reintroducing beaver or doing simulated beaver structures, but we need to do it strategically. A lot of really good work in the [organization] happens with pilot studies… sometimes it’s about helping build acceptance and considering the reaction of the people.

Not only do these entities have to consider the reaction of the public, but they also often need to implement public outreach programs and comment periods, as one participant explained:

There’s certain topics that tend to be more controversial than others and what we have found here is that tends to be more wildlife management based… so that is challenging, and you can address that through communication and education.

Considering public perception can sometimes lead to longer timelines for project development and implementation, creating challenges to working with other entities.

Lack of large-scale cooperative program

Participants identified lack of a large-scale cooperative program as a barrier to cross-boundary wetland stewardship. In Colorado, there is no state-level program that supports cooperative wetland management for organizations focused on wetland benefits other than wildlife habitat. One participant stated,

We would like to have some kind of formal wetland coalition or body across the state that meets on an annual basis or some kind of formal wetlands-specific communication. We don’t have that yet, but it’s a goal.

She went on to say that “reliable funding for a statewide initiative is one of the biggest barriers” to long-term cooperative management of wetlands between diverse organizations. Without a cooperative program that considers a broad set of wetland interests, organizations and agencies lack a channel to share information and discuss management.

Opportunities for cooperation

Benefits to cooperation

Analysis revealed four themes describing benefits to cooperation (Table 5). The benefit most often identified by participants was sharing or exchanging resources, such as funding and skills. Funding can be

| Table 5 Benefits to cooperation |
|--------------------------------|
| Theme                        | # of Interviews (n = 22) |
| Sharing resources            | 14                      |
| Extending your impact        | 7                       |
| Learning from other organizations | 5                     |
shared by pooling resources between entities, working with entities that have access to additional funds, or applying to grants together. As one participant explained:

As a group and partner, we can apply for and acquire grant funding, foundation funding, and maybe pots of money that the city and county aren’t able to access or don’t have time and staffing to access.

Many grants are awarded based on strength of partnerships and sometimes require matching funds, which applicants often obtain by working cooperatively with others.

Along with funding, each organization can bring a different set of skills to cooperative management. One participant described the benefits entities receive when working with his organization:

We are historically known as somebody who can bring good engineering to projects, which is often useful because there’s not a lot of engineering capacity within agencies interested in wetlands.

Another participant explained how additional resources can help entities accomplish more stewardship activities:

We try to find partnerships wherever we can, recognizing that the more expertise and more funding opportunities that we can have at the table, the more we can hopefully get done.

Not only can entities get more done by working cooperatively, but they can also extend the scale of their impact. One participant described their experience working cooperatively to achieve landscape-scale conservation:

We have had more draw to the area when we worked on a project, say, in northeastern Colorado on the South Platte where there was some Bureau of Reclamation-owned water or lakes and also a state wildlife area. Knowing that we have this kind of larger landscape-scale wetland complex that we are complementing and not just restoring a wetland in the middle of nowhere definitely had an appeal.

Another benefit is learning from other organizations. As one participant explained, “Sometimes they come to the table with really good ideas that you didn’t think of because you were in your bubble of doing the same thing you would do.” Working with others brings diverse perspectives to management, allowing entities to learn from one another and gain new skills.

**Defining success in cooperative management**

Overall, participants used many characteristics to define success in cooperative management. Definitions of successful cooperation varied significantly within entity type, illustrating that determinants of success vary with the individual. Despite this variation, common themes included meeting objectives, open communication, trust between entities, and developing a lasting partnership (Table 6). The majority of participants stated broadly that meeting their project objectives or the objectives of the group has made cooperative management successful.

Improvement in the ecological conditions specific to the entity’s goals and missions, such as improvement in wildlife habitat or water quality, was often mentioned as part of these objectives. Participants explained that along with meeting their own objectives, it is important to understand the objectives of their partners in order to find places where those objectives overlap.

Honesty, trust, and transparency among partners were also identified as characteristics defining successful cooperation:

Building trust is the first thing that makes [a partnership] successful. If you say you’re going to do one thing and do another, there goes the partnership right there and there.

Another participant explained that “being able to communicate honestly and openly” is important for cooperative management. He went on to say:

| Theme                     | # of Interviews (n = 22) |
|---------------------------|--------------------------|
| Meeting Goals and Objectives | 14                       |
| Communication and Trust     | 8                        |
| Sustainability             | 6                        |
I have seen situations where you see folks are communicating a lot, but there’s a lot of things that aren’t being said. It’s important you guys are able to be comfortable with each other so that if you do have discrepancies, you can work through that instead of pretending they don’t exist because you can’t solve a problem that you won’t acknowledge.

For participants from nonprofit organizations, sustainability of the partnership is what makes cooperative management most successful. One participant explained that cooperation is successful “if that partnership endures beyond the project or the policy that we are pushing forward.”

Learning from current cooperation

Participants currently involved in cooperative wetland management shared their experiences and offered advice. Often one individual or a small group of individuals leads and maintains the cooperative arrangement. As one participant explained,

It often comes down to, like, is there one mover and shaker that is willing to keep everybody organized that comes around the table for meetings and to discuss partnership opportunities both generally and for specific restoration projects?

Many organizations have liaisons to help facilitate connections between agencies and organizations. This often happens at the field level: scientists, specialists, or “on-the-ground” managers.

Finding common ground and understanding that everyone is coming to the table with a different perspective are also important aspects of cooperative management:

I think it’s great that everyone has different opinions and different visions for the future and then also having an understanding of once you get to the planning part that you might not get everything you want out of it. It’s about compromise… and seeing how you can find that common ground.

Learning from other organizations was identified as a benefit to cooperation so it is important to understand how entities currently engaged in cooperative arrangements effectively work together.

Discussion

This case study shows that many organizations and agencies are faced with managing the impacts of jurisdictional boundaries on wetland ecological systems in the greater RMNP ecosystem, including different management practices and water uses, and are concerned about continuing impacts from climate change, population growth, and development. Rapid population growth in national park “gateway communities” across the United States is creating challenges for planning and development (Stoker et al. 2020). Over the last decade, both gateway communities to RMNP, Grand Lake and Estes Park, have experienced a 7–9% increase in population (U.S. Census Bureau 2020). As populations grow, more pressure is put on scarce resources, such as water. Participants in this case study are concerned that as population continues to grow in areas around RMNP and along the Front Range, more infrastructure will be built by water rights holders to divert and store water upstream from the wetlands they manage. In order to ensure that wetlands have enough water to function, and that connectivity is maintained or restored, entities must cooperate across boundaries with those that hold water rights for different uses.

In order for cross-boundary cooperation to be successful, barriers must be overcome and opportunities to facilitate and maintain cooperative arrangements must be utilized (Fig. 2). Themes identified by case study participants for opportunities for cooperative management are separated in two categories-facilitate and maintain. The “facilitate” category consists of themes from cross-boundary influences on wetland integrity and benefits of cooperation. The “maintain” category is comprised of success characteristics and current cooperation themes.

In this case study, most participants were able to achieve successful cross-boundary stewardship as the benefits of cooperation outweighed the barriers. A few case study participants suggested ways to overcome barriers that led to unsuccessful cross-boundary interactions. We compiled a list of common challenges and corresponding solutions to assist entities in developing and maintaining cooperative management.
arrangements (Fig. 3). The barriers and methods to overcome them identified in this study are consistent with findings from previous research on cooperative management (Yaffee 1998; Daniel et al. 2013; Floress et al. 2018). Therefore, while specific examples are provided to situate the discussion with the context of the case study, general recommendations are also made to achieve cooperative management.

Cross-boundary issues and the management strategies used to address them occur at different scales with resources being contributed through either top-down or bottom-up efforts. Large-landscape strategies have been employed for wetland systems and watersheds that span across states and even regions (e.g., the Chesapeake Bay Watershed). These strategies are often top-down and reliant on congressional funds. In the greater RMNP ecosystem, cooperation often

Fig. 2 Conceptual model of themes for barriers and opportunities for cooperative wetland management

Fig. 3 Potential solutions for practitioners to overcome barriers to cooperative wetland management
occurs at a much smaller scale through ad hoc or sustained cooperation among the most relevant stakeholders and jurisdictions. For example, when ammonia deposition in RMNP was found to be caused by agricultural emissions outside of the park, land managers, university researchers, and environmental agencies worked together with agricultural producers to develop an early warning system in which producers could voluntarily minimize emissions during certain weather patterns known to increase deposition (Pina et al. 2019). This was a successful bottom-up effort between relevant stakeholders at the local-level. A similar approach should be taken to address cross-boundary threats to wetland integrity.

Due to the resource limitations that often occur from the bottom-up nature of these efforts, entities seek out cooperative arrangements where funding and staff can be shared, allowing them to extend their impact to tackle local-level issues. Many entities develop formal agreements that explain the terms of their arrangement for sharing resources. Funding programs often consider strength of partnerships when determining awards and require matching funds that can be obtained through cooperation. Though many agencies are faced with staffing reductions or inability to hire, non-profits often have access to a large volunteer base. Seeking out cooperative arrangements with entities that have needed resources can help overcome the barrier of resource limitations.

The effects of boundaries on environmental integrity can be caused by differing missions between entities (Landres et al. 1998; Hansen and DeFries 2007). These same mission disparities present barriers to efforts that could alleviate the ecological effects of boundaries. Missions and goals between entities often differ in scope and/or scale, but organizations tend to have the same overall goal of wetland stewardship. Identifying these overlapping goals can help entities overcome barriers created by differing missions. When organizations or agencies are focused on different aspects of natural resource stewardship, they also tend to have different skills. For example, in this case study, a federal agency that provides technical and financial assistance to agricultural producers often cooperates with a non-profit focused on wetland habitat conservation because the non-profit provides engineering capabilities the agency does not possess. Therefore, working cooperatively allows organizations to utilize the expertise of others.

The “silo effect” occurs when entities gravitate towards working with others that are most like them, creating a barrier to developing more collaborative, multi-disciplinary approaches to management and administration (Becv et al. 2015; Sayles and Baggio 2017). Entities may be more likely to adopt an approach to management that is most consistent with their agency’s “culture” (Brunson 1998), rather than management developed cooperatively. Silos often form in larger agencies and organizations that have hierarchical structures, where new employees may be fearful to reach outside of the structure of their agency to partner with other entities. Although many entities have policies for cooperation (e.g., U.S. Executive Order 13352- Facilitation of Cooperative Conservation), few individuals are trained on how to work with others to steward resources effectively. To overcome this barrier, agencies need to provide support, training, and incentives for their employees to seek out and participate in cooperative management arrangements.

Participants identified sustainability as a characteristic of successful cooperation. Because sustaining a partnership can be challenging, it is included under barriers in (Fig. 3). Cooperative arrangements can be sustained by building trust and engaging in honest and transparent communication. It is well established that trust is necessary in natural resources management, especially when working in cooperation with multiple land ownership types (Bergmann and Bliss 2004; Stern and Coleman 2015). Many agencies and organizations hesitate to embark on the journey of cooperation if they believe the partnership won’t last. Honest and open communication about needs and expectations will help build trust and sustain the cooperative arrangement.

Since municipalities and federal agencies have a responsibility to serve the public, public perception can influence their objectives and activities. Trust and uncertainty contribute to this perception and affect the development of cooperative management between private landowners and public agencies (Bergmann and Bliss 2004). Public perception can also influence how these agencies work with other organizations. Participants stated that before implementing a management plan, they must build acceptance and trust. This can be achieved by including community outreach as part of a cooperative management strategy. Participants also noted that public perception considerations can lead to longer project timelines.
Being aware of the responsibilities and requirements that partners must meet can help overcome this challenge. Interview participants suggested that a strong leader or liaison can help agencies and organizations understand the shared value of cooperative management. Creating roles within organizations specifically to facilitate boundary-spanning—“working to enable exchange between the production and use of knowledge to support evidence-informed decision making in a specific context” (Bednarek et al. 2018)—can help entities overcome disparities in their missions or goals. Boundary spanners can be individuals that help organizations or agencies work cooperatively or entire programs dedicated to bringing different entities together. In the greater RMNP ecosystem, a transportation agency hired a wetland specialist to span the “boundary” created by their organization’s mission by translating technical wetland information to their agency’s decision makers, thereby building trust with conservation entities to facilitate and maintain cooperation. Participants also identified the lack of a boundary-spanning organization as a barrier to cooperation. Though boundary-spanning organizations exist in Colorado, their primary focus is on river health or wetland-dependent wildlife. Wetlands provide many other benefits such as flood attenuation and storage, aquifer discharge and recharge, and nutrient cycling (Sutula et al. 2006; Mitsch and Gosselink 2007; Schweiger et al. 2019). To facilitate cooperative management for a larger array of wetland benefits and between entities with diverse mission and goals, a boundary-spanning organization may be the best or only effective option.

Participants in this case study cited the lack of a large-scale cooperative program as a barrier to entities working together to manage wetlands in Colorado. Colorado Parks and Wildlife manages a wetland program that organizes committees of wetland managers from different agencies across the state. Though this is a good start at cooperative wetland management, participants in this case study explained that the program focuses on wildlife, leaving out entities that focus on other wetland functions such as water management. To address other cross-boundary wetland threats, such as those identified in this case study, a statewide cooperative program that supports entities with diverse wetland interests would be valuable. Some researchers argue for the development of national wetlands commissions that foster interagency cooperation for wetland protection, management, and restoration (Endter-Wada et al. 2020). These national wetlands commissions would not only overcome policy shortcomings for wetland protection, but also encourage stakeholder involvement. This increased involvement by public and private sectors would promote awareness of the needs and interests of those affected by federal management decisions (Endter-Wada et al. 2020). Therefore, national wetland commissions could help overcome many of the barriers to cooperative management found in this research.

**Conclusion**

If wetlands and the essential ecosystem services they provide are to be protected into the future, cross-boundary cooperation between multiple entities will be essential. This case study revealed a desire and willingness to participate in cooperative management in the greater RMNP ecosystem, but potential cooperators face many barriers when developing and maintaining cooperation. In cases where the benefits of cooperation outweigh the barriers, cross-boundary cooperative management can be achieved. This research builds upon the cross-boundary cooperative management literature by examining a wetland-focused case study and incorporating views from many different entity types, as well as providing solutions to the challenges identified by managers. Although the particulars reported here might be unique to the greater RMNP ecosystem, we believe the barriers and opportunities identified in this study have applications in other landscapes and for other resources that exhibit similar landownership patterns. This includes informing governance arrangements such as network and collaborative governance in which entities form connections across scales to address natural resource problems that cannot be achieved independently (Emerson et al. 2012; Scarlett and McKinney 2016).

This research aimed to explore how cross-boundary wetland cooperation could be facilitated. Therefore, most participants in this study were not already involved in multi-jurisdictional wetland-specific cooperation. Future research should be conducted with entities that have successfully implemented ecosystem-scale wetland stewardship, such as Habitat Joint Ventures, to learn more about the challenges and
opportunities they faced. In addition, research should be conducted in other locations in need of cooperative wetland management to determine if the same themes are found. Finally, this research focused on cross-boundary stewardship centered on RMNP. Research on cross-boundary cooperation should be conducted with other national park and protected area centered ecosystems. This research suggests the enormous complexity inherent to cross-boundary cooperation and provides some direction for achieving cooperation among neighboring entities to improve wetland integrity.

**Author contributions** MT developed interview questions, conducted interviews, performed data analysis, and was a major contributor to the final transcript. MB assisted with research design including interview questions; reviewed interview transcripts and data analysis; and contributed to the final manuscript.

**Funding** The development of these ideas was supported by National Science Foundation Award #1617309.

**Data availability** The data that support the findings of this study are openly available in Hydroshare at https://doi.org/10.4211/hs.17600892c08447fd9c4df3a5c85b31b7.

**Declarations**

**Conflict of interest** The authors declared that they have no conflict of interest.

**Ethical approval** Ethics approval for this study was waived by the Utah State University Institutional Review Board according to federal guidelines 45 CFR Part 46.104(d) category #2.

**Informed consent** All participants included in this study gave written informed consent to participate in this research.

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