Transforming conflict over natural resources: a socio-ecological systems analysis of agricultural drainage

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Abstract

Agricultural drainage is a complicated and often conflict-ridden natural resource management issue, impacting contested ecosystem services related to the retention of wetlands as well as the productivity of farmland. This research identifies opportunities to transform the conflict over agricultural drainage in Saskatchewan, Canada, towards collaboration. We report on ethnographic research informed by a conservation conflict-transformation framework to evaluate the nature of the conflict and whether drivers of the conflict operate principally at the level of disputes over discrete ecosystem services or if they reach deeper into local social circumstances and build on larger unresolved conflict(s) among groups in the region. In addition to the conflict-transformation framework, we apply the Social–Ecological Systems Framework to elicit details regarding the substantive, relational, and material dimensions of this conflict. Our research suggests that processes for governing natural resources, such as those in place for governing drainage in Saskatchewan, need to have mechanisms to facilitate relationship building and shared understandings, need to be adaptable to people's changing needs and concerns, and should focus on inclusivity and empowerment of actors to address conflict.

Introduction

Agricultural water management (AWM) describes a set of on-farm practices for managing water for such purposes as flood control, irrigation, and nutrient management. One form of AWM is drainage, which involves steps taken to move surface water to make more land available for agriculture. Drainage can involve "tile" drainage, which relies on underground infrastructure (tiles), or surface drainage, which generally entails sloping, ditching, canals, and culverts. With tightening profit margins and rising production costs, farmers face many incentives to increase land productivity through drainage (Cortus et al. 2011; Wheater and Gober 2013; Weber and Cutlac 2017). But, drainage can have complex social and ecological consequences and trade-offs, which make it difficult to govern effectively (Breen et al. 2018). While landowners may use agricultural drainage to mitigate their own water and flooding issues, the resulting changes in hydrology can affect numerous ecosystem services on which downstream users rely, including flood risk mitigation, freshwater quality, and biodiversity (Bethke and Nudds 1995; Dumanski et al. 2015; Morton et al. 2015;
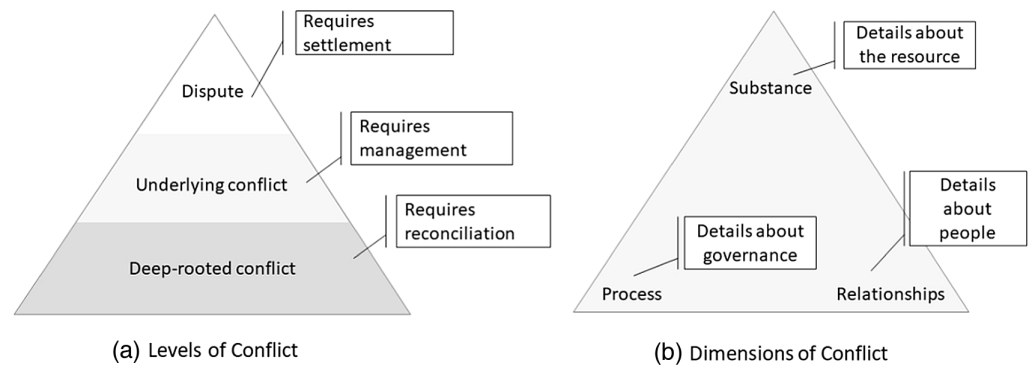
Fig. 1. The Conservation Conflict Transformation framework (adapted from Madden and McQuinn 2014). A conflict can exist at multiple levels (a), and entail challenges related to the resource, the processes surrounding resource use and management, and the relationships among people in the system (b).

Badiou et al. 2018; Pattison-Williams et al. 2018). There is little consensus among stakeholders on the relative risks and impacts of drainage, making it a contentious topic that can divide communities as they debate the best way to manage land, water, and diverse ecosystem services in light of equally diverse human needs and values.

In this research, we explore the linked, social–ecological dimensions of AWM, specifically drainage management, and the conflicts that are presently arising because of trade-offs among agriculture, wetlands, and communities. We explore the question: "What factors contribute to conflict about agricultural drainage in Saskatchewan, and what options are there to foster collaboration over conflict?" To answer this question, we engaged in ethnographic research with stakeholders in various aspects of drainage in the province, including farmers, landowners, watershed associations, stewardship groups, provincial authorities, and numerous interested nongovernmental organizations. As an analytical lens, we draw from the conservation conflict transformation model proposed by Madden and McQuinn (2014), which identifies three degrees of conflict complexity and also provides a three-part conceptual map for exploring the multifaceted relationships among the processes, relationships, and substance of conflict (Fig. 1). Our goal is to explore how different stakeholders conceptualize conflict over drainage in the province, and we find that people generally place much greater emphasis on the human and social components of drainage conflict than they do on its ecological, climatic, or other biophysical dimensions.

Our findings shed light on the difficulties of managing conflict in so-called "wicked problems", and reveal the conflict surrounding drainage was often straying from conflict directly about the formal drainage process (what we identify as the dispute level of the conflict). Actors involved in agricultural drainage pointed to issues with governance systems and relational aspects of the conflict (e.g., people's actions and interactions) as the most central conflict drivers in agricultural drainage. In this paper we unpack the escalating conflict to highlight governance challenges associated with competing visions for land use and conservation. We find that to work towards resolving this conflict stemming from drainage, Saskatchewan needs to have more inclusive and empowering mechanisms within the drainage governance process. These governance mechanisms should facilitate both relationship building and the building of shared understandings of the drainage landscape, and they should be able to adapt to people's changing needs and concerns.

Background

Agricultural drainage, and primarily surface drainage, has long been a core component of AWM in Saskatchewan, playing an important role in early settlement and construction of the province's urban centers and transportation infrastructure (WSA 2017). Saskatchewan's economy has historically been dominated by agriculture, and agriculture is still a top contributor to the livelihoods of many in the province, especially in rural communities. Cropland comprises the majority of agricultural production in Saskatchewan (e.g., canola, wheat, lentils), covering 36.7 million acres. At the national and global level, cropping in Saskatchewan contributes significantly to the Canadian economy and to global food security (Earls and Hall 2018), and any reduction in agricultural productivity in the province could have significant implications for the sustainability of rural households, communities, and the province as a whole.

Agriculture in Saskatchewan is strongly influenced by its cyclic climate, which is characterized by multi-decade wet–dry cycles that alternate among periods of severe drought and flooding (Bonsal et al. 2013; Wheater and Gober 2013). In recent years, Saskatchewan has also experienced extreme precipitation events that have motivated farmers to escalate the amount of land that they drain (Pattison-Williams et al. 2018). As such, the ability to manage surface water is essential to managing climatic variability while maintaining the livelihood of farmers in Saskatchewan. However, changing technology, urbanization, and changing societal values for land use have increased conflict around drainage. For example, prairie wetland areas have been recognized for providing multiple regulating, provisioning, and cultural services: they sequester carbon, provide habitat for wildlife, support water quality, increase surface water storage capacity (i.e., the volume of surface water storage available in a watershed), and provide opportunities for a variety of types of recreation (Cortus et al. 2011). These various conflicts surrounding drainage, and a lack of well-developed policies and regulations in place to mitigate negative impacts of agricultural water management, ultimately pressured the Saskatchewan Government to change regulations around AWM (Breen et al. 2018).

In 2015, the provincial government deployed a new AWM strategy, followed by Bill 44, which aims to bring all agricultural drainage into compliance over the next 10 years and gives the Water Security Agency (WSA) powers to close or alter noncompliant drainage works (Legislative Assembly of Saskatchewan 2016). This now means that the majority of drainage works in the province are considered illegal, as any drainage works without a permit is considered illegal (Breen et al. 2018). The new approach aims to:

> Permit agricultural drainage while reducing risks of local to large-scale downstream flooding and infrastructure damage, degraded water quality from erosion and increased contaminants, and negative impacts on wildlife habitat (WSA 2017, para. 3).

To receive a permit from the WSA there must be evidence that the water can be moved to an adequate outlet. The WSA describes the adequate outlet as:

> [The] location where no further land control is required to address neighbour to neighbour flooding impacts. The intent is that at the POA [point of adequate outlet], the additional water from drainage works will not create flooding impacts on lands outside of the Crown-owned bed and shore (WSA n.d.-b, p. 147).

Under the new system of permitting, landowners must group together in a "drainage network" to develop a permitting plan for all drainage in a particular region. These new drainage networks can be initiated by anyone, but the province has actively prioritized and supported the development of new networks in areas where there have been complaints or requests for assistance on the matter. This process aims to create efficiency in approvals by requiring groups of farmers and other land

and infrastructure owners and operators to work together to design and operate the drainage project so it drains into an adequate outlet. The option of formalizing the network into a Conservation and Development Area Authority—a form of local government that draws legal authority from *The Conservation and Development Act*, RSS 1978, c 27—is encouraged. Conservation and Development Area Authorities are generally comprised of private landowners, who collectively have the authority to tax landowners to fund projects to resolve water management issues or soil erosion (WSA n.d.-b). In Saskatchewan, the Saskatchewan Conservation and Development Association (SCDA) is made up of a wide range of groups involved in agricultural drainage, with the mandate of "conserving and developing agricultural land through responsible surface water management" (SCDA 2019, para. 1).

One final important aspect of this new governance regime is the role of the Qualified Person (QP; i.e., a professional engineer, professional agrologist, applied science technologist, or an individual accredited by the WSA) (Breen et al. 2018; WSA n.d.-a). QPs act as the liaison between the WSA, network members, and other stakeholders, and they act as the project manager of the implementation of drainage works and are typically paid by drainage applicants (WSA n.d.-a).

As noted, conflict over AWM, including the province's latest approach to drainage, is widespread. Conservationists, lakeside cabin owners, farmers, ranchers, and rural municipality residents all have differing priorities for and experiences with the ecosystem services provided by water and wetlands, and in some cases, responses can be highly polarized when extremely wet or dry conditions create trade-offs among people's priorities. Cumulatively, these differing values make drainage governance something of a "wicked problem", which in short means that few people agree on the nature of the conflict or its possible solutions (Rittel and Webber 1973; Breen et al. 2018). Wicked problems are not unmanageable, but they do defy simple solutions or management strategies. Importantly, drainage-related conflict and other conflict over natural resources are not inherently problematic—conflict can contribute to healthy discourse and debate over values, needs, impacts, and issues such as ecological and social justice (Young et al. 2010). That being said, conflict, if left unmanaged, can escalate and become maladaptive, hindering the collective action necessary to achieve sustainable outcomes or respond to new and novel conditions (Bennett et al. 2001; Harrison and Loring 2014).

Research on the effective conflict management highlights the importance of looking at conflict as a complex system (Harrison and Loring 2020) and recognizing that conflict is often derived from more than just the surficial matters that are contested in specific disputes among groups (Madden and McQuinn 2014). To unpack this complexity, Madden and McQuinn (2014) proposed a two-part, "Conservation Conflict Transformation" framework for evaluating natural resource conflict (Fig. 1). First, this framework highlights the status of conflict—that is, whether the conflict is limited to discrete disputes or whether it builds on deeper ongoing histories of conflict. Second, the framework looks at the subject matter of the conflict and whether it derives solely from the substance of the conflict—in this case, whether there is too much or too little surface water on the landscape—or if the conflict instead relates to disagreements over the relationships and governance process. As Madden and McQuinn (2014) pointed out, if conflict management is only happening at the dispute level, e.g., through a formal process for registering complaints, but the conflict actually derives from histories of bad relations among groups or distrust of the governance process, conflict management will be ineffective at best.

Methods

To better understand conflict over AWM and drainage in Saskatchewan, we conducted ethnographic research in three regions of the southern portion of the province where drainage networks are working to permit drainage. An estimated 40%–70% of wetlands have been lost in the prairies since agricultural development of the area began (see Watmough and Schmoll 2007), and more than 90%
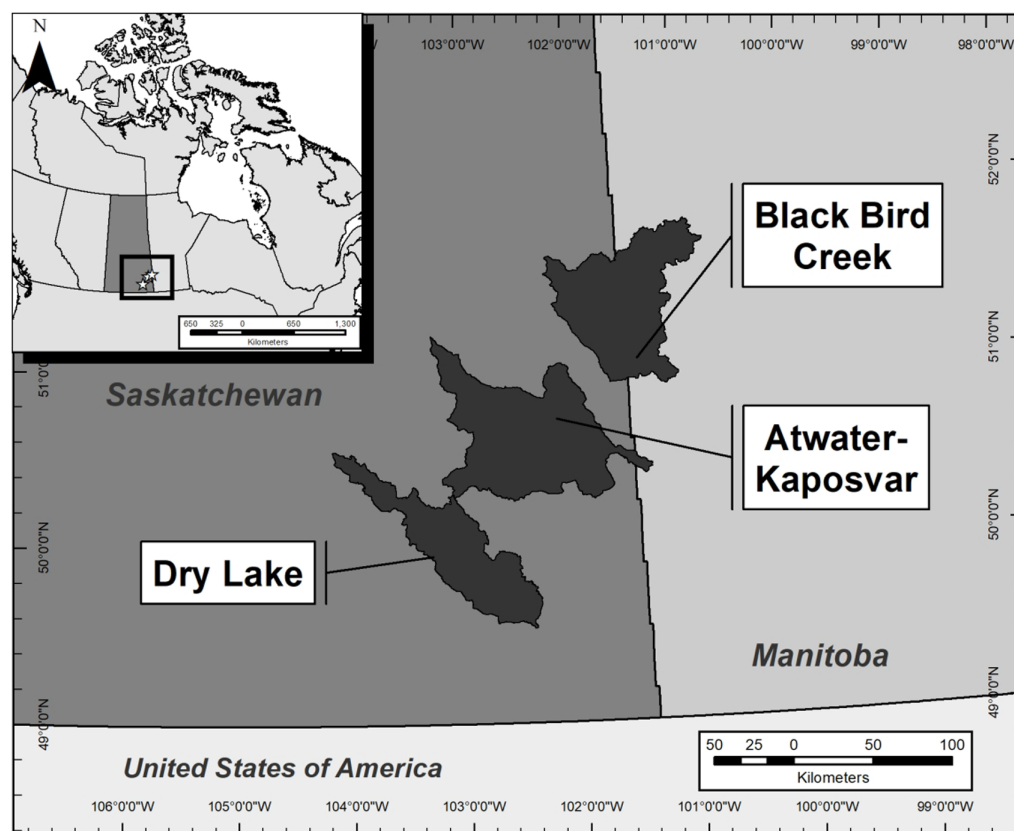
Fig. 2. Map of drainage networks (map credit: Jared Wolfe, map contains information licensed under the Open Government Licence—Canada).

of remaining wetlands show visible impacts of agricultural activities (impacts on wetland margin or basin; Bartzen et al. 2010). Wetland drainage is ongoing, with median loss rates of ∼4% (by area) in southern Saskatchewan for the period of 2001–2011 (PHJV 2014).

The three drainage networks in Southern Saskatchewan chosen as case studies for this research included: Black Bird Creek, Dry Lake, and Atwater-Kaposvar watersheds (**Fig. 2**). We selected these three networks through consultations with provincial experts in drainage governance as well as in response to community needs and interest.

We used four complementary research methods for qualitative data collection: key informant interviews, stakeholder interviews, site tours (e.g., farm visits), and community meetings. All methodological approaches involving human subjects were approved by the University of Saskatchewan's Research Ethics Board, and all participants gave informed consent prior to participating in the study. Building on previous agricultural drainage research conducted by team members and after an initial literature review, we created an interview guide with a focus on the history of agricultural drainage, general regulatory/policy contexts, network details and approvals, network implementation and enforcement, and conflict and challenges with agricultural drainage (Appendix 1).

In addition to semi-structured interviews, we also participated in several informal site tours of farms and watersheds (including conversation lands and properties not involved in agricultural production)

to gain contextual understanding of agricultural drainage scenarios and issues. On these tours we sought to listen to how farmers talk about and share the water management features and issues on their farms. We also used photography and field notes recorded after each interview or farm visit to capture additional context and inform our subsequent analysis. As we discuss below, these activities contribute to our ability to make rigorous decisions regarding recruitment and saturation as well as to our analysis and interpretation of our data.

We recruited participants from all three drainage networks, as well as from groups that operate provincially, such as conservation nonprofits, industry groups, and provincial agencies. We first identified key stakeholders in the drainage debate by reaching out to these organizations and then branched out from those informants, attempting to recruit a diverse, cross-section of stakeholders through snowball sampling. Our goal with recruitment was to achieve representative diversity of stakeholder perspectives (e.g., to hear from as many different kinds of actors, such that we could build a comprehensive understanding of the conflict). Generally, with this sort of interpretivist research, a modest sampling of diverse experts can yield a strong understanding of the scope of, and variation of perspectives regarding, the issue at hand (Guest et al. 2006). Determining appropriate sample size in qualitative research is an interpretivist process, one based largely on researcher experience and familiarity with the context of the research (Sandelowski 1995). In our case, our sampling goals were determined by achieving representative diversity of interviewees, ensuring that we included voices from all kinds of parties to the drainage governance system in Saskatchewan. This includes agricultural producers, engineers engaged in the permitting process, and representatives of government, watershed associations, conservation organizations, trade organizations, rural municipalities, and First Nations. We did not, by comparison, seek to include indirectly impacted stakeholders such as tourists, hunters, etc., as these groups are not directly party to the new system of drainage governance. We continued to recruit new participants until we reached data saturation, the point where it became evident that new interviews were unlikely to yield new information relevant to the research questions at hand (Saunders et al. 2018).

All interviews were recorded and transcribed. We coded interview transcripts and other notes both inductively (open coding) and deductively (closed coding) using NVivo 12 qualitative software. The open coding proceeded as an inductive thematic analysis (Braun and Clarke 2006), looking for re-occurring themes in the data, and then identified the subset of these codes that offer evidence regarding the status of the conflict based on the three levels identified by Madden and McQuinn (2014): simple dispute, ongoing conflict, and deep-rooted conflict (Table 1). We also coded transcripts deductively with the concepts offered by the Social Ecological Systems Framework (SESF, Fig. 3), to get a sense of how local people's understanding of the conflict maps to the conceptual dimensions of conflict identified by Madden and McQuinn (2014) (Fig. 1b). Developed primarily by Ostrom (2009), the SESF is a conceptual schematic and data dictionary for describing and diagnosing complex natural resource problems (see also Epstein et al. 2013). Here, the language of the SESF provides an additional level of detail regarding the substance and the relational and processual aspects of drainage conflict (Table 2).

The open and closed coding were conducted by two different researchers. After the first pass of coding all transcripts, the closed coder and the open coder came together to discuss findings, make refinements to the open codes, and discuss preliminary impressions and patterns. After this code calibration, preliminary findings were discussed among the larger research team, to ensure we weren't missing any important understandings from the data that were not captured within the closed coding framework. We also used member checking (i.e., ground truthing, Birt et al. 2016), which entails obtaining feedback from key researcher participants to ground truth our preliminary findings. Our member checking methods included one community meeting with Atwater-Kaposvar stakeholders,
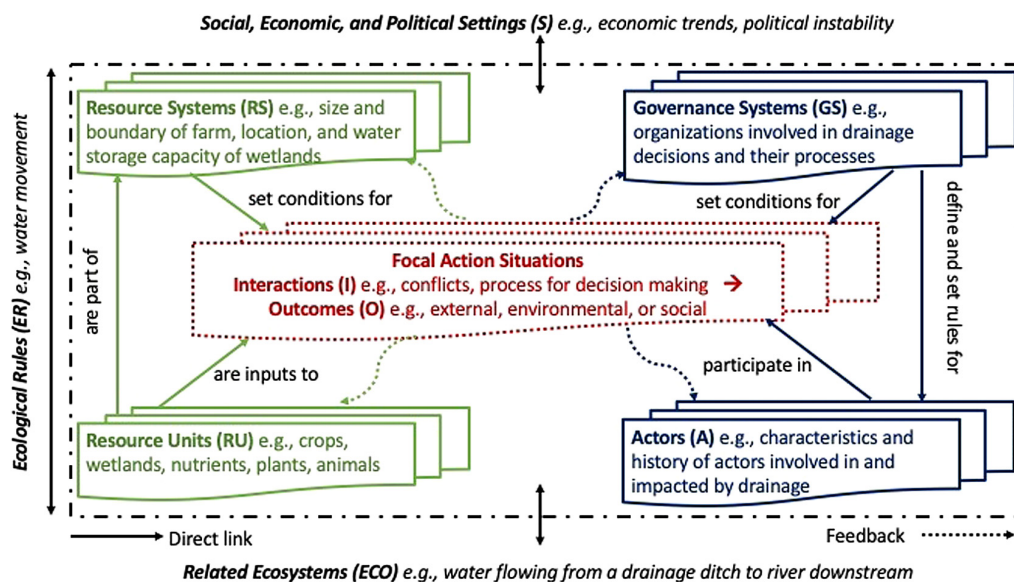
Fig. 3. The Social-Ecological Systems Framework provided additional concepts for exploring the conflict terrain shown in **Fig. 1b**. Specifics are noted here for the case of agricultural drainage, including sample indicators for each variable (adapted from Epstein et al. 2013; McGinnis and Ostrom 2014).

Table 1. Important research themes and nuances in drainage conflict that extends past the level of simple disputes to that of an ongoing conflict with deeply rooted drivers and factors.

Conflict stage	Theme (open coding)	Example
Dispute-level	Physical outcomes	Flooding in community, loss of a wetland
	Drainage activities	Ditch digging, drudging, opening control structures
	Process	Rules for permitting and compliance, definition of terms, cost
	Technical specifics	Mapping, lack of data, disagreement on technical matters
	Biogeography	Wet and dry areas, sloping, up- and downstream land use
	Enforcement	Who is enforcing and how
Ongoing conflict	Drainage network-specific dynamics	Histories among neighbours and families, rural development challenges, intra-group politics
	Compliance and enforcement	Patterns of enforcement (or lack of enforcement), perceived favoritism
	Information	Access to data, how data are privileged and shared
Deep-rooted conflict	First Nations	Conflict over land claims
	Institutions	Reputations, institutional values and mandates
	Mental models	Wording, disagreement over definitions (e.g., wetlands), disagreement over values (profit, conservation)
	Cycles	Conflict is inevitable and reoccurs
	Politics	Role of governance and government, rights, social license to operate

Table 2. Crosswalk of top-level variables from the Social Ecological Systems Framework and how they might map to the three dimensions of conflict identified by Madden and McQuinn (2014).

Conflict dimension	Social Ecological Systems Framework variable	Example
Substance	Resource units	Amount of water, hectares of wetlands
	Outcomes	Flooding, wetland loss, decline in watershed storage capacity
Relationships	Resource system	Ecosystem structure and function, predator-prey, habitat-biodiversity
	Actors	Histories among individuals, families, cultures
	Social, economic, and political setting	Laws, underlying economic trends, market demand
Process	Interactions	Processes for permitting or complaints
	Governance system	How power is distributed in rule setting and oversight
	Actors	Willingness to engage
	Ecological rules	Water balance, regional hydrology

two knowledge mobilization workshops with academic and academic associated stakeholders, and several follow-up phone calls with individual informants.

To further analyze the SESF coding, we created a code network based on code co-occurrence, where individual codes are coded in close proximity to one another in a transcript. This allows us to explore how people understand or observe relationships among the different components of the drainage social ecological system. For example, if a respondent talked about both actors' values and ecological rules when answering a single question, we are assuming that this means they recognize or intuit some fundamental relationships among these within the context of our question. This was an important analysis steps, as the semi-structured interviews conducted rarely followed the script of the interview guide in a sequential way, and we encouraged interviewees to return to other questions or link and expand upon answers during our interviews. We then completed a network analysis in UCINet software (a software package for the analysis of social network data) to explore both tie strength and degree centrality (Borgatti et al. 2014)—to identify whether any specific aspects of the SESF stand out in our collective analysis as particularly emphasized or absent. We interpret strong ties (high code co-occurrence) among SESF codes as indicating that people find these aspects of the system as being closely linked or related. We interpret high degree centrality (the relative importance of a specific node for creating the shortest path among other nodes) as signifying aspects of the drainage system that are most central in the discussion of conflict.

Results and discussion

In spring and summer of 2019, we completed 32 interviews with 36 respondents from a variety of sectors and stakeholder groups (see Table 3), which met the sampling and saturation goals noted above. Below, we report first on the results of the open thematic analysis of this research, which as a reminder, focused on the status of conflict. Then, we explore our findings regarding the nature of the conflict through the lens of the SESF and the three conceptual dimensions of conflict—substance, process, and relationships.

Table 3. Breakdown of interview participants.

Participant type	Total
Male	27
Female	9
Drainage network participants	
Farmer	7
Qualified Person	4
Non-network (broader scale)	
Farmer	8[a]
Provincial Government	6
First Nations Community	2
Agricultural Group	1
Environmental Stewardship Group	3[a]
Rural Municipality	1
Member of the Legislative Assembly	1
Technical Professional	4
	37[a]

[a]One participant represented more than one participant type in their interview.

Conflict status

We encountered much evidence that conflict over drainage is not constrained to dispute-level matters, but rather, that it builds on long-standing disagreements and deep-seeded differences regarding values for the land, the role of government and governance, and people's rights and responsibilities (Tables 1 and 2).

That being said, it is instructive to first explore some of the dispute-level features of the conflict that interviewees shared. Many people told specific stories about flooding events that affected their land or illegal ditching by neighbours. For example, one provincial staff member explains:

> There was a family at the bottom of the project living along Dry Lake with land owned in Dry Lake with flooding problems including house flooding that they attributed to drainage. We had complaints about it and we had orders issued in the past (Provincial Participant).

Another participant who represented both an environmental stewardship group and was a small farmer, expressed concern for the severity of some drainage decisions saying, "people are losing their homes, they're losing their farmyards, their buildings, their cropland because of what's happening upstream" (Environmental Stewardship Group/Farmer Participant).

These individual disputes notwithstanding, there is much evidence that that conflict over drainage is a mix of individual disputes that intersect with longer-standing conflict at multiple levels, some among families, others among stakeholder groups, conservation groups, and the provincial government. For example, several people raised concerns with us about unfairness in the provincial system for permitting and enforcement in terms of who was being targeted to be a drainage network and the uneven implementation and enforcement of new drainage policies. It was noted by one farmer, "Water

Security just kind of showed up and so we were trying to figure out, 'Why are they picking on us?' Nobody complained" (Farmer Participant).

Many people also talked about the role of long-standing family feuds as playing a role in current disputes over drainage. For example, there was one story told about a landowner holding off to sign the drainage network application, which was causing escalated conflict as this was delaying the process for drainage permits for everyone in the network. Incidents of lack of cooperation during the drainage process can be due to more than just concerns related directly to drainage. It was explained, "There's two reasons he's holding out. One is for money, and the other one is because my grandpa took his grandpa's girlfriend back in 1923 and they're still mad about that" (Farmer Participant). Another farmer explained that complaints about drainage sometimes were driven by reasons unrelated to the current issues, saying:

> He was complaining about land that he had felt was affected by illegal drainage but everybody in this project does illegal drainage. There's not one of us that has an approved drainage project … this particular complaint had more to do with history than anything else (Farmer Participant).

Finally, some interviewees also raised skepticism over the legitimacy of some data and science. It was explained by one farmer how they did not agree with data presented to them by the WSA regarding downstream impacts of drainage:

> I do honestly believe that the downstream effects of producer drainage are grossly exaggerated by people that are against it. A lot of this water runs off anyway, right. They have these natural water runs and a lot of it runs off. At the end of the day it's kind of these very small kind of potholes is the excess water that's leaving (Farmer Participant).

How institutional reputations, mandates, and culture play into conflict over drainage are also a good example of the conflict's deep-rooted nature. For example, many respondents are skeptical about the agenda of the WSA. We heard accusations of bias from multiple different parties, some arguing that the WSA is biased in favor of drainage, while others are convinced that they are against it. Among those interviewed who were most opposed to drainage, their perception of a profarming bias in the WSA relates to ongoing changes in WSA rules surrounding required wetland retention percentages and the fact that drainage permitting does not trigger an environmental assessment at the provincial level. This is important, because the drainage permitting process looks largely at water quantity issues and not at impacts of drainage on water quality or other environmental factors such as biodiversity. It was explained:

> … we're critical because all we see is these farmers that are draining wetlands, and they don't care about water quality to their neighbour, and the habitat that's being lost (Environmental Stewardship Group Participant).

On the other hand, a provincial staff member discussed how others assume that the WSA is anti-farming:

> We'll hear this [as] well, Ducks Unlimited wrote WSA's [Water Security Agency] policies. We'll hear that from certain groups out that way, because in our legislation it says we have to look at flooding impacts, water quality impacts, and habitat impacts. As soon as you start getting into the water quality and habitat impacts you start getting that anti-ag [anti-agriculture] sentiment from some people (Provincial Participant).

These perceptions among some farmer participants that the provincial policies are anti-agriculture also came up in discussions of an urban–rural disconnect, where farmers feel they are losing the

influence they once had in society, what some called "the social license to farm", partly due to pressures from a growing number of people in urban areas (Hall and Olfert 2015) that have a disconnect with farming and rural life. There is a perception among many farmers that we interviewed that urban residents generally do not understand agriculture, have an anti-agricultural drainage perspective, and have an inordinate influence on policy. It was explained:

> ...the farmers who elect the politicians in rural areas understand that more and more that they have to cater to the city people. So, all these pressures are building on the land-owners and rural Saskatchewan. That's why I say the issue is a rural issue, not just a drainage issue, so it's a consequence of the changing demographics, the loss of the farm connection, the heritage, the lack of reality built into our discussions on economic issues and production of food issues (Qualified Person Participant).

Finally, different people in this conflict are working with fundamentally different mental models about water, wetlands, and the roles of conservation and agriculture in society. For example, there is much disagreement about what constitutes a "wetland". Some farmers express dissatisfaction or disagreement with the widely used wetlands classification system in the province. One provincial staff member explained:

> Some landowners in that grain farm group, they will say class one, two, and three are sloughs and fours and fives are wetlands. They look at something that's bigger, more permanent, as a wetland and everything else that maybe goes dry in the middle of the summer (Provincial Participant).

Another farmer similarly offered, "To me 'wetlands' is a swear word, I don't use it very often. That's my nature, because it didn't exist until Ducks Unlimited came along" (Farmer Participant).

Some farmers also discuss how their on-farm practices provide unacknowledged conservation and stewardship value, such as when they leave wooded areas for habitat or only partially drain wetlands. Finally, some farmers made appeals to the need to "feed the world" as a justification for accepting some degree of land use change. One member of an environmental stewardship group explained, "we have a group that honestly believes that they're feeding the world, and there's a group that believes that we should probably be protecting our own backyard, not destroy that at the expense to feed the world" (Environmental Stewardship Group Participant).

Dimensions of conflict

Our goal for using the SESF as a framework for analyzing interview data was to develop a representation of how stakeholders understand and emphasize the relative importance of the social, ecological, economic, and political drivers and components of the conflict. As Madden and McQuinn (2014) explained, conservation conflict can have three dimensions—conflict over substance (e.g., resources), conflict over process (e.g., management), and conflict over relationships. Here, we find that people who are involved in the conflict largely emphasize the human dimensions of the conflict over ecological ones (Fig. 4), specifically issues related to governance, the actors involved, and interactions among them. What's more, there appears to be no direct link for people that we interviewed between the substance of the conflict—the ecological details of the resources (resource units/resource systems, e.g., land, water)—and the practical outcomes (outcomes, e.g., conflict, flooding) that they are observing. Also noteworthy and related is the relative isolation in the thematic network of the resource units (e.g., wetland, crops)—though this is arguably the physical nexus of the conflict. In other words, stakeholders are approaching drainage conflict from a more holistic than isolated perspective, emphasizing the entire system rather than discrete resource issues. It was explained by one farmer who describing the drainage area:
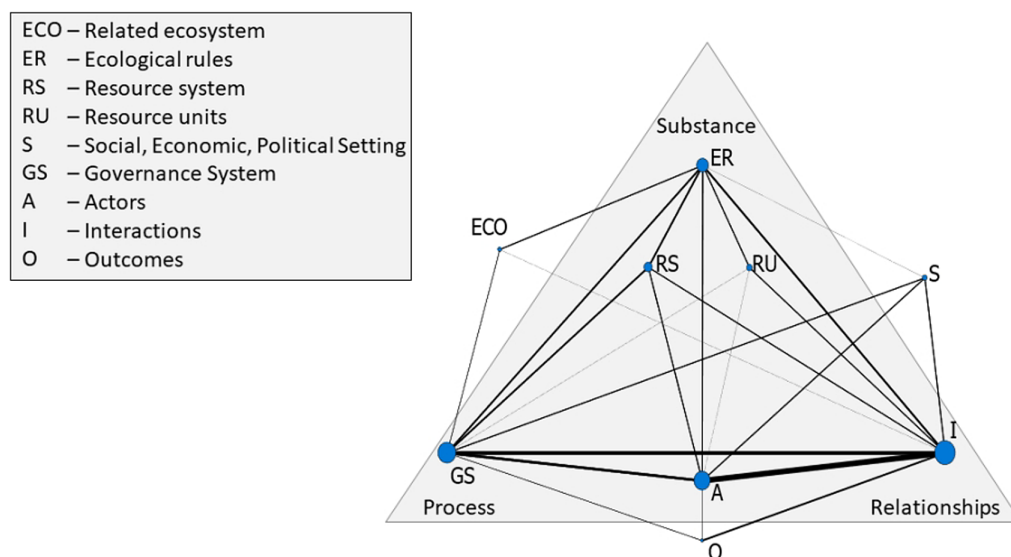
Fig. 4. Network analysis of code co-occurrence for Social-Ecological Systems Framework variables. Node size represents degree centrality (how importance the individual codes are for connecting all others); line thickness represents tie strength (how frequently the codes come up together in interviews). The network is superimposed upon Madden and McQuinn's (2014) conflict intervention triangle.

> . . . then it's important to know that the Kaposvar Creek feeds into the Qu'Appelle River which is a bigger water course along the bottom of the picture. And then the Qu'Appelle River feeds into the Assiniboine, then that feeds into the Red River by Portage and Winnipeg (Farmer Participant).

These are critical findings—people on all sides seem to share an understanding of the conflict wherein issues like rainfall, wetland size, or wetland number, etc., have little bearing on why conflict is escalating or connections to the outcomes of drainage and drainage policy. Instead, interviewees drew strong connections between the ecological rules of the system—the way they understand the functioning of wetlands and hydrology in the prairie pothole region—and how governance operates. That is, people are arguing that the governance system needs to do a better job of adapting to the ecological rules and social needs inherent to the system (e.g., institutional fit; see Young 2010). It was explained, ". . . they [the WSA] don't have enough local experience to understand where there is need for flexibility in the legislation" (Farmer Participant). To better understand these relationships between conflict drivers and potential opportunities for conflict management, we explore in the next few sections the various ways that respondents talk about these the processual and relational dimensions of the conflict.

Process-related dimensions of conflict

In the SESF, governance refers to organizations (government and nongovernmental organizations), and the process in place that govern agricultural drainage. As we note above, governing agricultural drainage in Saskatchewan is done under the AWM Strategy and more specifically Bill 44, an amendment to the *Water Security Agency Act* (Legislative Assembly of Saskatchewan 2016) that requires landowners to collaborate in networks for drainage permitting. Depending on the network there can be several governmental and nongovernmental organizations involved in the drainage application process, including the WSA (Provincial department responsible for permitting drainage works), rural

municipalities (responsible for drainage works going through roads and culverts), network members (i.e., landowners), Conservation and Development Authority (if one is established in the network area), and watershed associations (which have a varying amount of involvement in the network structure). The decision to become an official Conservation and Development Authority results in more control over the process, as Conservation and Development Authorities have more formalized rules for things such as levying or borrowing funds for the drainage works or to expropriate land (if required) (WSA n.d.-b).

Overall, we encountered three examples of conflict related to governance: exclusion of stakeholders, concerns about the permit application process, and inconsistent enforcement. With respect to exclusion, we heard from many interviewees that there are stakeholder groups being left out who should have a standing in either the application and permit approval process, whether as an applicant or to oppose decisions being made. These stakeholders include elected officials with agricultural drainage related agendas, First Nations communities, rural municipalities, agricultural associations, environmental stewardship groups, neighbouring provinces that are impacted by Saskatchewan agricultural drainage decisions, as well as academics and researchers who are influencing the conversation surrounding agricultural drainage. Consider rural municipalities, for example, who are not necessarily included in the decision-making process if the drainage works proposed do not impact municipal infrastructure such as roads and culverts. A rural municipality participant explained:

> If a drainage canal or a ditch is out on their field away from the road, we really don't have the authority so we can't do much about that. So, we get more of the negative feedback on that kind of thing and during the years when we had a lot of flooding, there were a lots of problems and there were people who complained to us quite a bit (Rural Municipality Participant).

This participant further explained that even though the rural municipal officials are receiving much of the local complaints about agricultural drainage issues, they do not have the power within the legislative process to influence permit decisions, which are made at the provincial level.

A second example of conflict over process relates to the WSA's lack of a clear definition and transparency for establishing networks and developing permit applications. Some farmers, for example, including those who have been part of a drainage network and others who were not part of a drainage network, regard the new process with skepticism and note changing or unclear rules. Others described frustration with the complexity of drainage permitting, arguing that the coordination requirements are too onerous. Better coordination between government departments as well as industry was also discussed as a need by both provincial and farmer participants. It was explained:

> The biggest problem we had is even within government, we had all these roads and highways, we've got electrical lines that are on the ground, we've got natural gas. So, we've got SaskPower, SaskEnergy, the Ministry of Environment, Highways, telephone, the RM's [rural municipalities], that you have to deal with all these agencies. And they do not communicate with one another. They're all involved; they're all stakeholders. Railroads and highways have put up artificial barriers, that weren't there a hundred years ago. They need to work together but government agencies do not work together because they're all empire-building (Farmer Participant).

Another process-related concern noted by many is the issue of enforcement and compliance. Many expressed concerns that the WSA is not enforcing compliance consistently throughout the province, but instead are focusing on catchments they determine to be at risk for flooding, or where there have been past complaints. The WSA explained that this perception relates to human resource limitations at the WSA. One municipal representative explained:

> We were not really sure why the province decided to go back pre-1981 because it seems to us, a lot of those drainage projects, it would be really hard to tell now. They almost look like they're in a natural state. So, the province said they're not going to look at them unless there are complaints so I said that's fair enough. This is a huge task, and I know that Water Security have suffered some cutbacks on staff and people that need to go out on the field and look at some of these projects, and I think that's where they're falling down a bit, I think they need some extra funding (Rural Municipality Participant).

The prioritization by WSA of areas where formal complaints have been previously lodged has also resulted in many people arguing that the new policy is effectively just a continuation of the previous complaint-based system. The people noting this issue explained that penalties for illegal drainage are not enough and are often just the cost of doing business for larger farmers. It was explained, "… what I would hear is a fine is the cost of doing business for some farmers. Say, $10,000 is nothing, for them to ditch they would make more money to ditch even with the fine" (Technical Professional). Furthermore, farmers explained that as long as you don't have issues with your neighbour's agricultural drainage practices, an informal agreement is still common in the province, which circumvents the official permit process.

Disputes and concerns about equity and conflicts of interest in drainage are also evident. One engineer, for example, discussed how funding for the new permitting process creates the possibility that it could be gamed by special interests:

> We are a water stewardship association, but our funding right now comes principally from the WSA, for me to serve as a QP on these drainage applications. So, on the one hand, we have a mission to steward [this] watershed, but on the other our bread and butter comes from helping farmers farm it. It isn't always a conflict, but it feels uncomfortable, and backwards. You can understand why people are skeptical (Qualified Person Participant, emphasis theirs).

Other respondents shared a concern about winners and losers in the new process, specifically regarding upstream and downstream participants. For example, how networks determine the location of the adequate outlet was hotly debated in some locales; in one network, for example, the selected location for the adequate outlet fell upon a small producer's land. Given there is no guarantee that having the adequate outlet on their property would not result in flooding, these landowners were in opposition. Without the support of this landowner, however, the entire network and permitting process reached a standstill. This generated a significant amount of animosity among farmers in the network, including suggestions by some that the land-owner opposed to housing the adequate outlet ought to be forced to do so. Ultimately, this required WSA intervention, a mediator got involved, and an agreement was negotiated.

Decisions about which kind of drainage infrastructure to use also emerged as a source of conflict. For example, gated culverts can be used to control flow volumes and attenuate flood peaks. In one drainage network, members did not consider using such gates, as there was already a great deal of conflict between network members, and the prospect of having a single person empowered to open and close control gates on different people's land was a nonstarter. In another network, we heard accusations from drainage network members that other landowners were intentionally not opening gates to purposely flood out their neighbours.

Relational dimensions of conflict

As we explain above, there are a diversity of actors involved in the province's new drainage network permitting process (i.e., landowners, QPs, WSA, watershed associations, rural municipalities), and there are also other actors who influence or are impacted by drainage despite not being formally involved.

These include tenant farmers who do not get a vote in the network structure, cottage owners impacted by flooding, First Nations, agricultural associations, environmental stewardship groups, neighbouring provinces (specifically Manitoba), and states in the United States of America. Relationships within and among these groups can also be an important dimension of conflict, including actors' understanding of the landscape, histories of collaboration or conflict in communities, and past experiences with the WSA. For example, some drainage network members noted to us that a history of draining water onto neighbouring lands without any communication, ensuing complaints to the WSA, has resulted in some networks starting from a place of conflict. One provincial worker explained:

> A lot of the other networks were initiated as part of a complaint, so to resolve the complaint, we have two options: get the complaint against works into compliance or close the works. That wasn't the case for this one, it was just a random "Hey we see that you guys have drainage, let's work with you guys, get it into compliance." So there wasn't that initial conflict to kick this all off (Provincial Participant).

Another provincial worker explained:

> A lot of times this stuff goes really deep and goes back decades and decades depending on these guys. Just personal stuff that stemmed when they were in elementary school kind of thing. It just kept boiling and building. Like there's a lot of underlying personal issues too, it's not just water … and [it's] multi-generational (Provincial Participant).

Further, the regulatory history of agricultural drainage in Saskatchewan has been a sticking point for many. The same worker continued:

> So, the notion that they've been able to do essentially what they want without any regulatory presence for a long period of time, they would prefer to keep that, in terms of their own direct interests for some folks (Provincial Participant).

On the other hand, we heard from farmers about how previous interactions with the provincial government was impacting their working relationships. One farmer explained, "the WSA didn't trust us out here as farmers, they thought we were a bunch of idiots and so yeah. The QP's really bridged the gap between the farmers and the WSA" (Farmer Participant). In sum, people's relationships when it comes to drainage are inherently contextualized by their past experiences with one another, fueling assumptions regarding bad or untrustworthy actors and undermining both effective collaboration and buy-in to the new regulatory process.

Lobbying and activism are also complicating people's relationships in a way that is causing the conflict to escalate. In Saskatchewan, pro-agricultural drainage and anti-agricultural drainage stakeholders disagree in both public and private forums. One interviewee explained:

> I'd say it's more two camps. In some circumstances, it's been hardening of lines instead of coming together and understanding, it's been more becoming entrenched into the various opinions (Provincial Participant).

Or, as an engineer explained:

> There's never going to be the perception that the people are playing fair with the people downstream. Let's not lose sight of the fact that the people who are earnest in getting the drainage done or getting the farm water management done are being opposed by some very big global environmental agendas, and I don't know how you fight that but you know so you've got somebody who has no interest in the drainage other than the ideological interest petitioning the government to do environmental assessments well you know that's almost a tyranny of the majority (Qualified Person Participant).

These quotes reflect a common, relational aspect of conflict escalation, where people start creating narratives of heroes, victims, and villains—narratives that alienate people from one another and undermine effective conflict management (Adger et al. 2001; Harrison and Loring 2014).

Lobbying was also noted by some as being a concern; several participants described involving elected officials in drainage conflicts to lobby for their rights. We heard stories where local members of legislative assembly in Saskatchewan were being lobbied to fight for drainage concerns (both those for and against drainage) in legislative debates. In one case, members of the opposition became involved, and attacks in legislature became personal against the local Members of Legislative Assembly. It was explained:

> There was something the other day in the legislature where the one individual went to the opposition and the opposition certainly made a big case about it in the legislature. In fact, even brought my name up in it which is a point of order … It got very personal (Member of the Legislative Assembly Participant).

Furthermore, producer groups, such as Saskatchewan Farm Stewardship Association, are a prominent proponent of agricultural drainage when it meets certain environmental protection requirements, and engage in a number of lobbying activities (Saskatchewan Farm Stewardship Association 2019). There is also a group called the Saskatchewan Water Council, which is associated with the Saskatchewan Chamber of Commerce (representing and advocating for the business community in Saskatchewan). This group was created as a "…result of [the] Water Security [Agency] not listening to people and not being open to working with people" (Agricultural Group Participant). These different lobbying activities continue to influence drainage conflict. As different actors in the system with similar special interests form groups, this reinforces certain perspectives regarding drainage, adds to the "us versus them" mentality regarding drainage issues, and further escalates the conflict rather than contributing to collaborative solution to the conflict.

Inroads for conflict management

As explored above, conflict over agricultural drainage is complex and comprises a variety of diverse values, perspectives, and agendas. The conflict reaches beneath the surface, past specific disputes regarding acts of drainage to reflect longer standing and deep-rooted disagreements among parties. The conflict also appears to be escalating, evident in fractured relationships and emerging narratives of heroes, victims, and villains. Therefore, to effectively manage the conflict, the various issues that people have with the process (e.g., concerns regarding transparency and fairness) and interpersonal relationships and histories (e.g., family feuds), need to be given due attention. However, the existing system of drainage governance is largely limited in its scope to the substantive dimension of the practice—that is, the planning and implementation of the drainage works themselves. To put it another way, the assumption seems to be that addressing the substantive aspects of drainage, and in particular finding a location for the adequate outlet, is sufficient to achieving uncontested and environmentally acceptable outcomes.

Best practices for conflict management, by comparison, stress the importance of process, and bringing people who are willing to step outside their personal biases together in a structured process for exploring options and trade-offs (Harrison and Loring 2020). It is the process of governance itself, not the outcome, that enables people to mend and rebuild their relationships such that any trade-offs or disagreements can be effectively and equitably navigated (Redpath et al. 2013). Key in that process are third-party brokers, people who can maintain independence (Redpath et al. 2013), and in our work, the QP emerged as a promising third-party broker. Provincial staff and farmers alike said that

QPs could serve as an important bridge between the WSA and stakeholders. One small farmer, referring to the QP in their network, explained:

> She listened to everybody; she was out here … Actually, she probably helped get the ball rolling with a lot of things. You know, showing WSA that all the farmers out here aren't just a bunch of liars or whatever, and they're draining and they want to help work and come to a proper plan and a project that's gonna work for everybody. Before that, there was so much … WSA didn't trust us out here as farmers, they thought we were a bunch of idiots and so yeah. The QP really bridged the gap between the farmers and the WSA (Farmer Participant).

In other words, the QP may be in a unique position in the regulatory process to enable more effective collaboration and conflict management, especially in where the science surrounding best practices is contested (Redpath et al. 2013). Along these lines, some interviewees suggested that future QPs ought to be trained in conflict management, as WSA's current QP training focuses only on technical competencies (WSA n.d.-b). As the province continues to adapt their facilitated networking approach, they might consider elevating the role of the QP as key for building trust and transparency. One challenge, however, is that the QP is a paid position, paid in some cases by landowners seeking permits, and in others, by the WSA. Given the concern noted about funding-oriented conflicts of interests, there is the potential that the QP could become a politicized position, which would undermine their perceived credibility as neutral party.

Conclusion

Conflict over conservation, and over ecosystem service trade-offs are rarely as straightforward as they seem; they can appear, on the surface, to be about simple disputes over resources or land use practices, but under that surface they in fact stand upon long-standing tensions, histories, and insecurities. While conflict can sometimes be important for achieving sustainable and equitable outcomes, it can also become maladaptive: schisms of anger and mistrust can develop between groups and undermine effective collaboration. If institutions for natural resource conservation and governance do not create processes that explicitly attend to these complex social dynamics, they can contribute more to the problem than to its solution. This is arguably the case regarding drainage in Saskatchewan—the government's process was designed to facilitate collaboration through networks of people tasked with working together to decide how best to manage water on the landscape. However, existing tensions among groups, issues with mistrust and transparency, and differing values for the land, are all confounding that process, and they are contributing to a situation where conflict may be poised to further escalate.

Here, we've shown that the conflict transformation framework offered by Madden and McQuinn (2014) provides great heuristic value for seeking out these various social and institutional dimensions of conservation conflict. It has become axiomatic to say that conservation is as much, if not more, about managing people as it is about managing a resource, and the participants to this research made clear to us that this is the case for agricultural drainage. It is evident that it is not sufficient to design a process that attends primarily to the substance of a conflict—drainage and disputes over drainage—without also creating a process that facilitates relationship building and shared understandings and a process that can adapt to people's changing needs and concerns. Honest brokers (i.e., an impartial mediator) can play a key role in this, though that role needs to be formalized in such a way that all parties can agree with, to keep it from becoming politicized. Given that the province is continuing to refine and implement new policies for water and wetland management, we hope that the findings reported here can contribute to a robust and inclusive approach moving forward that empowers people to manage and perhaps even resolve the noted conflict over drainage.

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Author contributions

SM, VG, PAL, HB, and S-PB conceived and designed the study. SM, VG, PAL, and S-PB performed the experiments/collected the data. SM, VG, and PAL analyzed and interpreted the data. SM, VG, PAL, HB, and S-PB contributed resources. SM, VG, PAL, HB, and S-PB drafted or revised the manuscript.

Competing interests

The authors have declared that no competing interests exist.

Data availability statement

All relevant data are within the paper.

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Appendix 1. Prairie drainage governance: topic guide draft

Finalized: 14 October 2018

Introduction

- Before we start, do you have any questions for me about the project or your participation?

- Please introduce yourself, your name, and the organization (if any) you represent.

- Please describe your connection to agricultural drainage.

- Describe the problem or challenge(s) you see related to drainage?

History

- Tell me about the _____ drainage network area.

  ○ Describe the area we are discussing (drainage network/watershed).

  ○ Tell me about the history of drainage in this area. What type of drainage is practiced here?

- How has agricultural drainage changed or impacted your land/the region?

- Tell me about your/your organization's involvement in agricultural drainage?

General regulatory/policy

- Is _____ an approved drainage network?

  ○ If yes, when was it approved?

  ○ If no, where is it in the application process?

  ○ If not in the application process, why not?

- What individuals or organizations are involved with the drainage approval?

  ○ What role does each of the above play?

  ○ Who benefits and how?

- How would you describe the relationships between participants?

- Are there those individuals or organizations who are not involved that feel they should be?

- o   Who?

- o   Why?

-    What resources are available to support participation?

-    What strategy document(s) or plan(s) related to the _____ drainage network?

Network details and approvals

-    How would you describe the goal of your network?

- o   Short term, long term

- o   Length of license applied for?

-    Can you describe the activities/works/infrastructure included within your application?

-    What amount of drainage currently exists in this area?

- o   How much of that is currently approved/under application?

-    What requirements did you/will you have to meet to have drainage approved?

-    What factors do you believe the WSA considers when approving an application?

-    What communication goes out about the drainage?

- o   Generally?

- o   Specific to the application?

-    What challenges influence the current application process?

-    What do you feel is missing from the current application process or Agricultural Water Management Strategy generally?

-    How are the cumulative impacts of networks and individual applications addressed?

Network implementation and enforcement

-    Who is responsible for implementation and operation of the drainage works?

-    What resources are available to support implementation?

-    Who is responsible for enforcement?

Conflict/challenges

-    Tell me about drainage specific conflicts and successes in this area.

-    Are there conflicts or history not related to drainage that influence the situation?

- o   If yes, please elaborate.

-    What factors influence/drive conflict:

- o   Preceding creation of an application

FACETS

- During an application (internal within the network)
- During an application (external from the network)
- How is conflict addressed/dealt with:
  - Preceding creation of an application
  - During an application (internal within the network)
  - During an application (external from the network)
- What challenges influence the network?
  - e.g., capacity, resources
- What challenges/issues need to be addressed? What are the impacts of these issues?

Conclusion/wrap up

- Is there anything you would like to add or anything important you feel we have not discussed?
- What results or deliverables from this project would interest you?
- Can we contact you with follow ups or invitations for future events?
- Is there anyone in particular you feel we should be speaking with?
- Thank you for your participation.