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# Framing the Fluidity of Water Management Conflicts in the Bagré Irrigation Scheme, Burkina Faso

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**ABSTRACT:** Anchored in qualitative and quantitative research, this article analyses the main factors of water-related conflicts in the Bagré large-scale irrigation system in Burkina Faso. It addresses the question of how conflicts over the uses of water emerge, and how conflict management works in terms of local conflict resolution mechanisms. The analysis illustrates how water-related conflicts are connected to material objects or assets as well as to the deviant behaviours of some farmers such as non-compliance with water allocation rules. The occurrence of conflicts and their severity depend on the nature and density of social ties between local stakeholders and the economic value of what is at stake. When solutions to water-related conflicts are contested by stakeholders they can become exacerbated until they extend beyond the irrigation scheme and spread to other social spheres at the village and regional level; this shows the fluidity of water-related conflicts and their potential to grow beyond the issue at hand. The article points out that water conflicts are settled with the help of various social actors, networks and mechanisms, and through interpersonal negotiations which unfold in farmer-based and official institutions. The article goes on to argue that because of the social networks that connect local actors, and because of the necessity of preserving social peace, farmer-based institutions and face-to-face conciliation are the most commonly used conflict resolution mechanisms; through these mechanisms, those participating in irrigation schemes have modified the ways in which local institutions deal with water-based conflicts.

**KEYWORDS:** Irrigation systems, water resource management, rural livelihoods, water conflicts, conflict management, Bagré, Burkina Faso

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## INTRODUCTION

Together with five other Sahelian countries (Mali, Mauritania, Niger, Senegal and Chad), Burkina Faso has signed the Dakar Declaration of 31 October 2013, which inscribed irrigated agriculture as the cornerstone of these countries' economic development. Its take-off must happen through the implementation of diversified systems of hydro-agricultural management as well as the revitalisation and expansion of existing large-scale public irrigation schemes, mainly where rice production predominates (Bazin et al., 2017). As national economic growth and development policies are primarily based on agriculture, with significant expectations from irrigated agriculture (Burkina Faso, 2016), the construction of irrigation facilities has been undertaken over the past four decades (Sally et al., 2011).<sup>1</sup> Hence, the development of irrigation technology in agriculture is presented as holding the promise of improving agricultural production by promoting efficient water and labour management, and in this way contributing to improved nutrition and food security in Burkina Faso.

Water management in sub-Saharan African irrigation schemes is a crucial challenge because of chronic water scarcity, legal pluralism, and competing uses and claims on the limited quantity of water available. The flexibility of the rules and valuing of water accentuates the multiple, and new, claims that are

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<sup>1</sup> Sally et al. (2011: 378) showed that there are more than 1300 reservoirs in Burkina Faso. Since the droughts of the 1970s, the construction of dams was chosen as a measure to secure water for people and their livestock.

sometimes "conflictual and irreconcilable" (Venot and Cecchi, 2011). This situation has become more critical with climate change, which exacerbates the fluctuations of resource availability, competition and conflicts over water in dryland Africa (Roncoli et al., 2009; Woodhouse and Muller, 2017). In this dynamic, water rights must be frequently re-negotiated due to the multifaceted and competitive interests of the stakeholders at different scales. Hence, exploring 'water stress' (Wolf, 1998)<sup>2</sup> and water conflicts in an irrigation landscape requires unravelling both the different purposes and strategies of water uses and how the actors and strategic groups (including irrigators, herders, engineers and bureaucrats/administrators) are connected in the institutional network of water.

With development interventions such as irrigation schemes, the ambiguities and struggles around irrigated land and water rights have been amplified in rural Burkina Faso (Faure, 2003; van der Schaaf, 2008; van Koppen, 2000). As both land and water are scarce resources, irrigation systems are arenas of struggle and conflict; as Homer-Dixon (1999: 8-9) points out, it is for this reason that scarcity of natural resources generates uncertainties and competitive uses of those resources. Accordingly, coping with scarcity and competing legal and operational rules concerning water resources is subject to uncertainties, threats and tension (as well as cooperation) among farmers, as well as among farmers, state officials and private operators (Meinzen-Dick and Pradhan, 2001; Petit and Baron, 2009; Sally et al., 2011; van Eeden et al., 2016). Irrigation systems therefore are battlefields involving various actors and strategic groups interacting within legal frameworks and 'self-organising processes' (Lansing, 2003) to gain access to, and control of, scarce land and water resources. In the absence of sustainable social and technical responses to scarcity and uncertainty, conflicts, violence and ethnic-related disputes are prone to arise in the concerned landscapes (Homer-Dixon, 1999).

Implementation of Integrated Water Resources Management (IWRM) in Burkina Faso has been focused on the management of reservoirs and other water bodies as well as on irrigated agriculture (Cherlet and Venot, 2013; Petit and Baron, 2009; Roncoli et al., 2009; Sally et al., 2011; Venot and Cecchi, 2011). Institutional reforms were undertaken with the implementation of a water policy framework and a national action plan (the *Plan d'action pour la gestion intégrée des ressources en eau*/Integrated Water Resources Management Plan, or PAGIRE). These reforms include the installation of five river basin agencies and five local water management committees (*comités locaux de l'eau*, or CLE) – for example the Nakambé CLE (which is in charge of water allocation at the basin level) and the Nakambé Water Agency (which allocates water at the sub-basin level) (Venot et al., 2014).

This study focuses on water conflicts in the Bagré irrigation system, which is a gravity-fed irrigation system located on the White Volta (Nakambé) River in south-eastern Burkina Faso. The construction of this irrigation scheme echoes the public ambition of increasing the availability of cereals through rice production by farmer cooperatives on the order of the state agencies (Faure, 2003; van der Schaaf, 2008). Under the aegis of this public vision, the irrigation system has played an important role in farmers' livelihood strategies in Bagré. Institutionally, Bagré is characterised by a singular model of water management. For the past two decades, the irrigation scheme has indeed been managed by a specific organisation under the Ministry of Agriculture of Burkina Faso, and it is now managed by a semi-private organisation which reports to the Prime Minister; there is therefore little space for decentralised or integrated water management. Given the creation of a 'public utility area' (*zone d'utilité publique*) which has instituted an 'exception area' (*domaine d'exception*), there are fewer pathways for national policy to be applied; thus, the role of the community and local water management apparatus remains weak.

Created in February 2007, the CLE in Bagré aims to initiate action for development at the local level as well as to protect and restore water. The CLE also aims to be an interface between local water users and public institutions, and to offer advice on water-related decisions; however, this local water management forum is confronted with operational difficulties. Those difficulties are mainly due to its

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<sup>2</sup> "The scarcity of water in an arid and semi-arid environment leads to intense political pressures, often referred to as 'water stress', a term coined in 1989 by Falkenmark" (Wolf, 1998: 2).

members' lack of understanding of its mission, low levels of user mobilisation, and lack of sufficient financial resources to carry out planned activities. Therefore, if in theory the reforms aim to integrate local users into water management, in practice institutional changes are brought about by the structures of the state rather than by users; thus, apart from local big men (such as traditional chiefs and leaders of local associations), ordinary users are not fully involved, which explains the weak social legitimacy and the low performance of the CLE (Venot et al., 2014: 161).

The analysis of water conflicts in the Bagré irrigation system is structured around three questions. Stemming from the need to update the knowledge on conflicts over resources – mainly water in irrigation systems – the first question asks how conflicts over water spread at different scales inside and outside of large-scale irrigation schemes and affect other realms of social life. The second question explores how bureaucratic or 'socially embedded' institutions<sup>3</sup> (Cleaver, 2002, 2012) deal with water conflicts. The third question looks at how construction of the irrigation scheme has reconfigured the ways that local institutions deal with water-based conflicts.

### ANALYTICAL FRAMEWORK

It has been a challenge for scholars, policymakers and development agencies to understand conflicts over land and water in sub-Saharan African irrigation systems. Many studies carried out in recent years have explored and even predicted tensions and conflicts over irrigation water. Generally this body of research has focused on the risks of water conflict at the national or regional scale (Bethemont, 2009; Niasse, 2005; Postel and Wolf, 2001; Wolf et al., 2005), and it has partially addressed triggers and the likelihood of conflicts in irrigation schemes, with a focus on small reservoirs (Carney, 1998; Roncoli et al., 2009; Sally et al., 2011; Van de Giesen et al., 2010; van der Schaaf, 2008). As stated by Van de Giesen et al. (2010):

Small reservoirs are defined as reservoirs with a surface area between 1 and 100 hectares and a storage capacity of less than 5 million cubic metres. Typically, such reservoirs are located on the headwater of an ephemeral stream where they catch water during the wet season, to be made available during the dry season.

In line with van de Giesen et al. (2010: 1035-1037), I argue that small reservoirs fit better with downward accountability and are less prone to conflicts of interest than are large-scale irrigation schemes. Only a few studies (Bazin et al., 2017) explicitly focus on conflict management mechanisms in large-scale irrigation systems. Explored as a dimension of such research but not as their core topic, the issue of water conflicts in large-scale irrigation schemes remains under-studied. This paper, rather than being a partial examination, is devoted to a systematic exploration of how water-related conflicts emerge, evolve, spread out of, and are regulated within and outside of the irrigation landscape.

Theoretically, this study builds on the categorisation of conflicts proposed by Gluckman (1965) and Hagberg (1998). Gluckman states that "'conflict' should be circumscribed to refer to 'oppositions compelled by the very structure of social organization'" (1965: 109). "As a set of normative orders, dispute or conflict is a test of power between rivals that may generate violence" (Hagberg, 1998: 67). Moreover, conflict must be distinguished from disagreement (Gulliver, 1979); the difference between these two types of social interactions lies in their form of expression and resolution process as well as in the identity and interests of the parties. Disagreement is a "dyadic and private problem" (Hagberg, 1998) that is caused by struggles over scarce resources or material goods, tension over the right to take a

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<sup>3</sup> Criticising the unfruitful dichotomy which, in institutional theory, is made between 'formal' or 'modern' institutions and 'informal' or 'traditional' institutions, Cleaver suggested alternative labels by rejecting these false polarisations; to distinguish between institutions, she used the concepts of 'bureaucratic' and 'socially embedded'. She pointed out that "[b]ureaucratic institutions are those formalised arrangements based on explicit organisational structures, contracts and legal rights, often introduced by governments or development agencies. Socially embedded institutions are those based on culture, social organisation and daily practice, commonly but erroneously referred to as 'informal'" (Cleaver, 2002: 13).

decision or an action, or power; these are issues that can be resolved between the opponents themselves. Disagreements, however, can "bounce back and forth among and between levels", and can stir up oppositions that may turn into disputes (Hagberg, 1998: 76). In contrast to disagreements, disputes result from the failure of contending parties to resolve their disagreement or the unwillingness of one or both to do so. According to Hagberg (ibid: 68; citing Nader and Todd, 1978: 14), the dispute process is structured in three steps: i) the grievance or pre-conflict step, ii) the conflict step, and iii) the dispute step. The first stage refers to a situation in which actors and social groups consider themselves to have been wronged, causing them to feel resentment or have complaints; this stage normally involves the individuals or groups directly affected by the grievance. At the second stage, if the aggrieved actors or groups decide to voice their concern to the offending party, the contention may evolve and reach the conflict stage; thus, the opposing parties are both aware of the conflict. Third, the dispute stage is engendered by an escalation of the conflict, which then becomes 'overt' or is 'expressed', a 'public matter'. This last stage involves a third party which actively participates as broker, mediator or supporter. Furthermore, in such a situation the conflict may remain implicit or 'cold' (for instance, a 'conflict of interests'); 'cold conflict' is an emic term (a term used by those within the group) which refers to a creeping disagreement or deteriorated social relation without an open violent clash. A conflict is perceived as cold when a confrontation between the protagonists does not include crude violence (for example, a verbal confrontation). An explosion or 'escalation' puts an end to the coldness of a conflict; it becomes thus an open conflict that can lead to violence.

For Yasmi et al. (2006: 539-544), the manifestation of conflict escalation in natural resources management is a dynamic process that emerges over a period of time. It is a process that is characterised by increased intensity or worsening of the conflict and an increased number of participants who go from 'light disagreement' to 'open war'. It reflects material incompatibilities as well as differences of values and beliefs concerning resources. Yasmi et al. (2006), moreover, have identified eight stages of escalation of a natural resources management conflict: feeling anxiety (anger, grievance, disagreement over decisions/issues, etc); debate and critique (open debate, verbal clashes, quarrels, critiques of government policies); lobbying and attempts at persuasion (lobbying for compensation, persuading governments to acknowledge local rights, lobbying politicians); protest and campaigning (protests by local people, farmer rallies, protests against a particular plan, etc); access restriction (squatter invasion, imposed restrictions on subsistence activities, forced resettlement, displacement, relocation by force, invasion by the landless, etc); court (court appeal, litigation, etc); intimidation and physical exchange (threats, intimidation, machete fights, violent clashes, etc); and nationalisation and internationalisation (protests in national and international media and courts) (ibid: 542).

In large-scale irrigation schemes there are frequent disagreements, cold conflicts and open conflicts over water access. The occurrence of such social oppositions depends on the social ties between the parties, their social or economic capital, and the economic value at stake. In this research, 'water conflict' refers to disputes or physical clashes between stakeholders over water use and control (Korbéogo, 2018); for instance, disagreements or conflicts over water access and water fees arise when some farmers violate the established rotation across the canals or are reluctant to pay their regular water fee. In these cases, farmers' behaviour distorts the principle of equal rights over the resource (frequency and duration of watering) and of their duty as water users (water fee).

With regard to common-pool resource management, such as water sharing, there are two kinds of equality: proportional and numerical (Schnegg et al., 2016: 581, citing Aristotle, *Nicomachean Ethics*, 1130b-1132b). Proportional equality illustrates the fact that everyone pays for the water they use (i.e. the more water a farmer uses, the more he pays), whereas numerical equality refers to water pricing according to farm size (number of hectares). Given the difficulty of measuring the quantity of water used by individual farmers and evaluating the related cost, numerical equality is applied in the Bagré irrigation scheme. In such a context, when people violate the official schedule of water provision or do not pay

their fee in time, they produce a situation of unequal access to water which can lead to concomitant disagreements or conflicts.

In the case of escalation, conflicts move from antagonisms between individuals or social groups to disputes with far-reaching consequences in local or regional public spheres. A striking feature of resource conflicts – particularly water-related – is their *fluidity*, that is, their ability to spread into other areas of social life. Exploring the evolution of conflicts at the international level, Leboeuf (2005: 1) notes that

[o]ne of the most striking aspects of international conflicts is their increasing capacity for rapid and wholesale transformation. This fluidity is redefining the actors in terms of sociology, operational methods and objectives; their tactics and the general dynamics of warfare in the new international environment are changing.

Furthermore, Wolf et al. (2005: 81) found that

(...) water-related disputes must be considered in the broader political, ethnic, and religious context. Water is never the single – and hardly ever the major – cause of conflict. But it can exacerbate existing tensions and therefore must be considered within the larger context of conflict and peace.

Water conflicts can be settled by following a myriad of mechanisms, including interpersonal negotiation/conciliation, mediation by 'socially embedded' institutions, and adjudication by public institutions at the local or supra-local level. Negotiation processes are directly dealt with by the opponents themselves (self-help) or in the presence of facilitators (as opposed to decision-makers); adjudication mechanisms (Gulliver, 1979), on the other hand, require the involvement of a third party, an individual or institutional actor who is invested with legitimate authority that is recognised by the antagonistic parties. Interpersonal/face-to-face arbitration on the basis of operational or pragmatic norms is thus referred to as negotiation, and institutional mediation following legal or official rules is what I refer to as arbitration. Resource-based transactions such as water sharing are embedded in other social bonds such as ethnicity, membership in associations, marriage, etc.; because of this "interconnectedness in multiple networks" or "institutional multiplexity" (Schnegg et al., 2016; Schnegg, 2018), informal and farmer-based associations are more salient in conflict resolution than formal or state institutions. The importance of social networks in resolving conflicts around resource sharing is likely to preclude the autonomy – individual agency – that some aggrieved farmers may seek.

Drawing on this theoretical framework, this article focuses on the reasons for, and the resolution of, conflicts around the management of water in the Bagré irrigation scheme; it frames them in relation to the social and institutional structures within and outside of the irrigation scheme.

## STUDY DESIGN AND METHODOLOGY

To explore water-related conflicts, a mix of quantitative and qualitative methods has been used. For the quantitative survey, a questionnaire was administered to 131 rice farmers who were randomly selected from the total of 1301 producers in the irrigation scheme at that time; the interviewees were generally male farmers and were heads of their households. All farmers in the existing irrigation system in Bagré are members of a producer organisation. The producer organisation's membership lists – which were confirmed by the list provided by Bagrepole (the institutional apparatus in charge of the scheme management) – were used as a sampling frame. Random sampling was used to reach all possible categories of rice farming households and to ensure the validity of statistical analyses. With the help of two field assistants, the questionnaires were administered at the homes of interviewees or in the rice fields, according to the convenience of the farmers surveyed. To tackle the constraints and to ensure that the assistants did the fieldwork honestly and efficiently, occasional field checks were organised. The questionnaire included questions on household structure (demographic and socio-economic data), organisation of agricultural work, educational and professional background, reasons for the choice of

irrigated rice cultivation on the site, experience of irrigated rice cultivation including difficulties and solutions to difficulties, the constraints and advantages of membership in the rice producer cooperative, rules of water sharing, conflicts over water and consequences of these conflicts, institutional and local processes of water conflict resolution, and the identity of the protagonists of water conflicts. The questionnaire data was analysed through four closely related operations: constitution of categories based on the items/answers, coding of the raw data following these categories, tabulation, and statistical analysis.

Household-based surveys may be criticised because they render invisible the realities of some of the household's members, especially women, children, male and female employees of the household. To improve sampling precision, qualitative investigation has been used to register information on marginalised statistical categories such as women and young people; in this way, what seems to be peripheral or less significant to household-based surveys becomes central. The qualitative techniques (open-ended and semi-structured interviews, focus group discussions, secondary document analysis) aim at eliciting information on the informants' social backgrounds, how they have accessed their irrigated plots, their perceptions and uses of land and water resources, their experiences of water-related conflicts and their perceptions of the institutional management and outcomes of these conflicts. For the qualitative investigation, a purposive sampling method was used to select the informants; it focused on farmers officially registered with Bagrepole as smallholders on irrigated farms, civil servants, political leaders in each ethnic group (Bisa, Moose/Mossi and Fulbe/Fulani), cooperatives and union leaders, women, and herders. Direct observation on farms, at local meetings, and during mediation of water conflicts was useful for several purposes: assessing the social interactions between the farmers, state officials and private actors; observing some schemes for water allocation and water use; and examining conflict management processes. Spending time with various actors and strategic groups in small-scale social interactions was useful in that it was possible to observe directly, participate, and listen, recording detailed information related to the observed facts or events (as raw data) in a notebook. This qualitative raw data was processed and then edited into readable categories (quotations) for purposes of content analysis; furthermore, case studies on water conflicts provided details about the lives and conditions of the stakeholders, allowed different types of issues and conflicts to be followed, and enabled researchers to trace the paths by which water-related conflicts are defined, perceived and addressed locally. The qualitative research thereby helped to clarify how water-based conflicts are related to the physical and institutional environment as well as to farmers' behaviour, daily practices of water use, knowledge and social networks.

The core of the data collection occurred over three months in 2015 and 2016, which included the warm period, the harmattan season (a dry windy period between November and March) and the rainy season. Drawing upon empirical evidence from mixed methods of data collection, this article explores the socio-historical factors of water conflicts and provides valuable insights into how actors and strategic groups deal with water conflicts in an irrigation system in rural Burkina Faso.

## **RESEARCH SETTING: SOCIO-ECOLOGICAL BACKGROUND OF THE BAGRÉ IRRIGATION SCHEME**

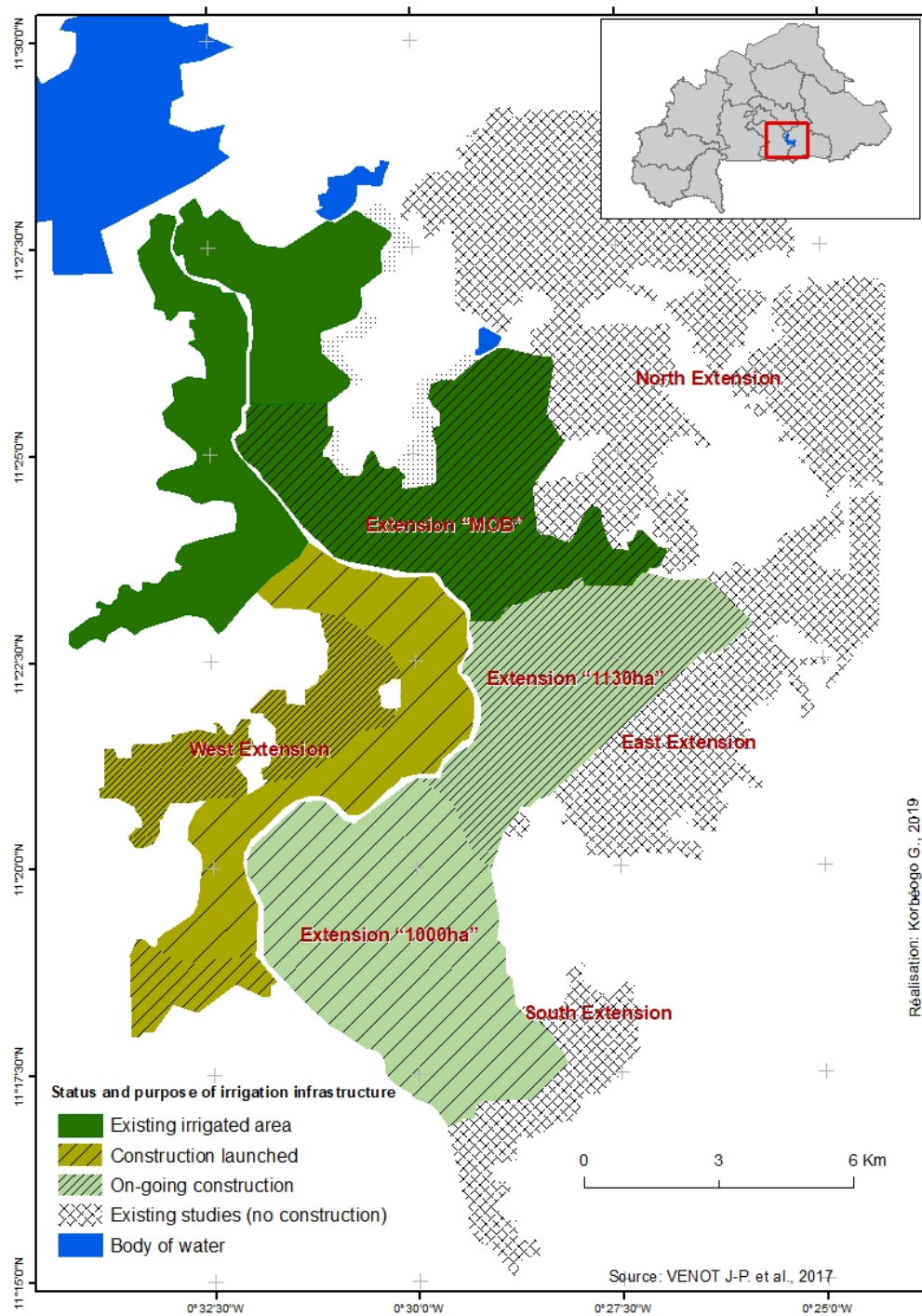
The Bagré dam is built on the Nakambé River (or White Volta) in south-eastern Burkina Faso (Cecchi et al., 2009; Faure, 1996). Located in the Sudano-Sahelian climatic zone, the Bagré irrigation system is characterised by an inter-annual rainfall of about 1000 mm, with a rainy season that varies in duration between five and six months (Commune of Bagré, 2013; Millogo et al., 2018). Built in 1991 and in use since 1993, the Bagré dam is Burkina Faso's largest hydropower facility, with a storage capacity of 1700 million cubic metres (Mm<sup>3</sup>) (Cecchi et al., 2009; Sally et al., 2011). At the time of its construction, two irrigation offtakes existed: one on the right bank with a potential flow of 10 cubic metres/second (m<sup>3</sup>/s) and another one on the left bank with a potential flow of 28 m<sup>3</sup>/s (Bazin et al., 2017: 7). Before the building of the reservoir and the resulting impounding of the area's water, the area's natural resources

were used by the Bisa clans and Fulbe groups to carry out their economic livelihoods and social customs, including agriculture, hunting, livestock and ritual ceremonies (Faure, 2003). The Bisa are the first-comers (indigenous inhabitants) and customary landowners, and those who migrated into the area later (late-comers) are mainly Fulbe and Moose (Faure, 1996).

Prior to the establishment of the reservoir, the communal landscape was used for subsistence and commercial agriculture as well as livestock farming (Faure, 2003). The main crops were cereals grown for household use, and vegetables mainly produced by women; non-timber forest products were also collected and sold commercially. Early studies on the socio-economic effects of the Bagré irrigation system (Faure, 1996; Faure and Konaté, 1996) showed that it threatened the livelihood strategies of many social groups; this included women whose economic vulnerability increased with the dispossession of their source of income. Furthermore, the project jeopardised the spiritual connections between the autochthonous Bisa clan members and their communal environment. Popular anger grew at what was perceived as resource grabbing by the state; this was exacerbated by the negligence of the public administration in not informing – much less negotiating with – local people as to the decision-making and implementation processes of the project, including flooding and emergency releases. Because they were deprived of information and not included, local people organised several social protests and sabotages in the course of the dam's construction (Faure, 2003). The dam project was perceived by some interviewees as a 'forced dispossession' of their community-based natural resources by the state. A Bisa farmer who witnessed the beginning of the project testified, in an April 2015 interview, that "[t]he construction of the dam was marred by protests from local populations who perceived the appropriation of the land by the government as a confiscation, a forced expropriation. Our opinions and interests have not been sufficiently taken into account".

There are different phases of the irrigation schemes (Figure 1). The first phase runs from the launch of the project in 1986 to 2011; during this phase the project was under the control of the Maitrise d'Ouvrage de Bagré (MOB), which is the focus of this historical overview. The second phase is the development since 2011 under Bagrepol, which resulted in the construction of infrastructure. A pilot project of about 80 hectares (ha) called 'Petit Bagré' (Small Bagré) was launched in the mid-1980s with the financial support of the Agence française de développement/French Development Agency (AFD). The MOB was created in 1986 as a public agency to supervise the irrigation schemes and the construction of the dam. Between 1995 and 2002 a rice scheme of 1200 ha, funded by the International Cooperation and Development Fund of Taiwan (ICDF), was built on the right bank of the river, and in 1996 the first cohort of rice farmers was settled. In 1998, the project area was recognised as a public utility area; this granted the MOB, under the aegis of the state, "the right to expropriate people in the sake of public interest" (Venot et al., 2017). In the course of expanding the capacity of the irrigation scheme, two new extension projects were implemented, one between 2002 and 2004, and one between 2006 and 2009. The first expansion was a 600 ha rice scheme, which was funded by the West African Development Bank, the AFD, the African Development Fund, and the European Development Fund. The second expansion was a scheme of 1500 ha built with the financial support of the Kuwait Fund for Arab Economic Development, the Islamic Development Bank, the European Development Fund, and the Fund for International Development (OPEC). By 2009, out of the 33,000 ha area downstream of the dam that was expected to be irrigated, only about 3380 ha were equipped for irrigation and less than 3000 ha actually had functioning irrigation systems (Venot et al., 2017). This slowdown in the irrigation development plan is due to the low productivity of rice cultivation, the managerial constraints of the MOB, and the lack in capacity of the water user associations (Kaboré and Sedogo, 2014; Venot et al., 2017). The Bagré large-scale hydraulic infrastructure, however, offers a full range of facilities of which the most important are electricity, fishery, tourism and market-based agriculture (Cecchi et al., 2009; Villanueva et al., 2006).

Figure 1. The research setting.



Source: Venot et al. (2017).

Note: MOB = Maitrise d'Ouvrage de Bagré; ha = hectares.



The development of irrigated areas allowed for the establishment of new generations of professional rice producers who were organised by the state into cooperatives. These producers were recruited from indigenous Bisa from the region of Tenkodogo, as well as from Moose migrants from central and northern Burkina Faso (including the regions of Yatenga, Sanmentenga and Zorgho). They were selected according to specific criteria: Burkinabe citizenship, marital status, having at least four farm workers (with at least one full-time worker, or *actif*), and permanent residence in the village. Each household was allocated a one-hectare irrigated plot for rice cultivation and two hectares of rainfed land, in accordance with the project strategy of sustaining local livelihoods. Some indigenous people refused to let migrants use the rainfed fields that had been allocated to them by the MOB because they had claim on these lands. In all cases, no title was given to the farmers; they were granted an 'exploitation license', which could be transmitted to the household members, while land ownership remained with the state. The farming households have an average of ten members, with an estimated total population of 16,730 inhabitants; there is limited access to agricultural technology (inputs and farm machinery like tractors and water-pumping machines) and credit because of large unpaid bills at the cooperatives. Under such conditions, the rice fields typically are ploughed using simple manual equipment (40%) and animal traction (60%, including 48% with cattle and 12% with donkeys) (Kaboré and Sedogo, 2014). Tractors are only used in a few cases, usually by the local peasant elite who have acquired additional acreage through informal agreements with farmers who failed to cope with the financial burden of production.

The main requirements that go with the distribution of irrigated land to local farmers – which are inscribed in the official specifications (*cahiers de charges*) – are: living in the rice farming villages, cultivating on plots delimited in terms of number of hectares, producing mainly rice, and complying with the technical protocols and rhythms of production (two cultivation seasons per year). In addition to land use rights, access to water resources is also subject to fees; the violation of these hydro-agricultural norms can lead to the withdrawal of distributed irrigated plots. The institutional governance of the irrigation scheme is also realised through the creation of ten new 'villages', numbered V1 to V10. 'V' refers to village, but, in fact, each of these socio-spatial units is more like a neighbourhood of households belonging to the same rice cooperative; together these villages form the union of rice farmers. Following the perspective of Scott (1998), the creation of rice farming villages (*villages artificiels*), the allocation of fixed farmland based on geometrical 'reason' (size measured in hectares), and the imposition of water tax can be seen as a part of a political enterprise which consists of regularising the productive resources (land and water) and the smallholders' irrigation systems into 'standard', 'legible' and 'quantifiable' units for the purpose of levying state taxes.

By building a big dam with irrigated plots for rice production and reallocating the use rights of the plots to smallholders, the Burkinabe state has legalised and legitimised its control over irrigated land and water resources. The development of irrigated agriculture has transformed the socio-spatial, agrarian and cultural profile of the Bagré area (Ouédraogo and Janin, 2004); the area has developed into a more modern place, with an increased and more varied population which includes farmers, marketers, engineers and civil servants.

## RESEARCH FINDINGS AND DISCUSSION

### Framing water-related conflicts

Water is the source of life, and as such it is at the root of many social interactions and bargaining processes; it is the subject of disagreements, conflicts and disputes, particularly in cases where it is being mismanaged. The analysis below aims to examine how individuals and strategic groups perceive, identify and label (that is, frame) patterns of water-related conflicts in everyday life. On a broad scale, quantitative data from Bagré shows that among sources of conflict the most frequent are water-related (57.8%). This is followed by conflicts between farmers and herders because of crop damage (15.1%),

between farmers and union leaders over leadership (10.4%), between smallholder farmers and agribusinessmen (5.5%), ethnic-based conflicts (6%), and other kinds of conflicts (5.2%). Table 1 offers a statistical overview of the types of local water-related conflicts. These conflicts concern less than half of the surveyed rice farmers; a total of 59 individuals (45%) have experienced water-related conflicts, compared to 72 respondents (55%) who have not.

Table 1. Water-related conflicts typology (with 95% confidence intervals).

Type of conflicts	Frequency (n)	Percentage (%)
Violation of sequential rotation of water	26	19.8
Water scarcity/low water pressure	15	11.5
Non-payment of water tax	5	3.8
Crop damage by cattle	10	7.6
Deviation of canal water	3	2.3
None	72	55
Total	131	100

Source: Personal data of G. Korbéogo.

### Conflicts due to unequal water distribution

Rice farmland is watered through a gravity-fed irrigation system. Water flows from the reservoir to the irrigated fields through a network of primary, secondary, tertiary and quaternary outlets.<sup>4</sup> The primary and the secondary outlets are under the control of the Bagrepol technicians, while the tertiary and the quaternary are self-managed by the farmers through their representatives. Water engineers sometimes supervise the irrigated areas or are consulted by farmers as necessary or in emergency situations. Water distribution is scheduled according to blocks of rice fields which are designated by a combination of two letters (e.g. AS, BS or CS); each section is further divided into sub-sections (AS1, AS2, etc). AS1, for example, is composed of 18 rice plots which are supposed to be irrigated simultaneously; ignoring the allocation timetable causes disparity in the use of water and increases the likelihood of water-based conflicts.

Among the five main types of conflicts listed in the questionnaire, the dominant type is the violation of the distribution schedule laid out in the calendar of sequential water distribution that has been agreed upon by stakeholders. Farmers who disregard the distribution schedule usually go by night (often after midnight) to clandestinely open the outlet valve; they also divert water from its normal trajectory towards their rice plots. Additionally, when farmers consider that their fields are sufficiently watered, some of them use the same processes to block canal water runoff; such behaviour can disrupt the timing of water flows and may cause flooding of nearby fields. These contentious actions are mainly noticeable at tertiary water outlets (from canal to field boundaries) and at quaternary outlets (from field boundaries to crops). In an April 2015 interview, a smallholder Bisa farmer testified that

[t]he water distribution is organised here. If everyone respects the planning, there is no problem! Unfortunately, some peasants think that they are the cleverer. So, even if it is not their turn to have their farm watered they come secretly in the night to water theirs. These bad behaviours are prone to conflicts,

<sup>4</sup> The primary outlet is at the basic source point; the secondary outlet is the supply point of the canal from the primary outlet valve; the tertiary outlet is the source of supply from the secondary outlet; the quaternary outlet directly serves the fields.

sometimes serious conflicts. If we cannot trust each other anymore, we cannot live together peacefully. This usually happens during the hot season.

A Bagrepole water engineer, in a June 2015 interview, commented further that "sometimes there are disputes over respecting the water distribution programme; but when these cases happen, producers inform us and we manage the problems. The conflicts increase especially during the hot period". The conflicts due to the low pressure of water or water shortage mostly occur during the hottest months of the year (March and April), when fields are relatively dry and the flow of water is slower and weaker. In explaining this occurrence of water scarcity, interviewed farmers refer to two main causes. In a June 2015 group discussion with female and male farmers from the Moose community, participants commented that

[t]he water shortages are due to the fact that the canal network is poorly designed and because of the clogging of the gate valves by garbage [grasses and used plastic bags]. Sometimes we have to open the gates, but every time when we plan to do it, the farm workers mobilisation is always insufficient, so we cannot organise collective work for cleaning the hydraulic infrastructure (...). Previously when we got together to do regular maintenance, it was better. But since the trash is invading and sometimes clogging up the passage points of the water it has become difficult.

A Bisa farmer, also in June 2015, commented that

[t]his is not a real plain. In the past this place was occupied by hills that have been turned into plains. Geographically one can perceive that it is not really a plain. They have transferred the soil from above and brought it to another place before covering the hole. It is therefore an artificial plain.

In times of water stress, some farmers declare that they sometimes wait three to four days before having their fields irrigated; particularly the farmers from V8, situated on a high slope with respect to the water level, complain about water scarcity. Because of this, some informants question the quality and efficiency of the irrigation infrastructure; such complaints are also reported by Kaboré and Sedogo (2014). Indeed, direct observation and interviews indicate that misuse of the irrigation infrastructure coupled with irregular maintenance of irrigation canals may explain why the water supply system is not working to its maximum efficiency.

Figure 2. Waterways clogged with stones, grass, and worn clothes, which slow down the flow.



Source: Personal photo of G. Korbéogo, taken 27 March 2014.

Along the canal, stones, grass, used clothes and plastic bags are used by some farmers to regulate the water flow to their advantage (Figure 2); in dealing with this type of interference in equal water distribution, farmers become practiced at initiating collective action. In the process of resolving such problems, they discuss the issue within their own networks before voicing their concerns to the public officials who are in charge of the irrigation systems. To address the collective cleaning of the canals, if necessary each household deploys its own domestic labour force to clean the water circuits that lead to its farm. In response to this illicit manipulation of water flow, sabotage actions are carried out on the irrigation infrastructure by a group of dissident farmers; these farmers also open closed valves in order to increase discharge. Such behaviours impinge on the interests of neighbouring producers, giving rise to a sense of grievance which has a high probability of leading to conflict.

Diversion of water, furthermore, is linked to its use for purposes other than that of rice cultivation. Such illicit actions are often carried out by farmers who are not members of the cooperative, and who install motorised pumps to draw water from canals to irrigate their fields of banana, vegetables, *Jatropha curcas*, etc.; which are located outside the scheme. Such practices reduce the amount of water available to regular rice farms, a situation to which many interviewed farmers attested. When such cases occur, aggrieved farmers voice their concerns about what they call 'water theft' directly to the offending individuals, who are often owners of neighbouring farms. If the latter admit their wrongdoing, the disagreement does not get worse; it remains a 'cold conflict' between two parties. However, if those accused of being self-serving try to defend themselves and justify their behaviour, then the grievances are framed more formally and become a public matter that can be presented for adjudication to the institutional hierarchy. In that case, in accordance with the typology defined by Yasmi et al. (2006), the escalation of water conflicts evolves in various forms: 1) 'feeling anxiety', which expresses grievance or disagreement over water use; 2) 'debate and critique', relating to verbal clashes or quarrels; 3) 'lobbying and attempts at persuasion', which deals with lobbying for compensation or persuading authorities to acknowledge local rights; 4) 'protest and campaigning' by local people; 5) 'access restriction', which imposes restrictions on resource access, or carries out forced displacement; and 6) 'court', involving litigation within formal institutions.

As already mentioned, water sharing is based on sequential rotation within the irrigation scheme. The rules of water are designed, applied and monitored by state engineers with the participation of the leaders of farmers' cooperatives. With regard to compliance with official rules, unequal access to water (other than when caused by ecological imbalance or poor quality of infrastructure) occurred only in a few cases. Water supply rules are meant to guarantee the interests of the majority of smallholder irrigators, a principle that is echoed in Ostrom (1990) and Schnegg (2018), who attest that natural resource management institutions – specifically those operating in water resources – are oriented towards satisfying the expectations of the majority.

### Conflicts due to water fee

Access to irrigation water is subject to biannual fees of €19 for one hectare (€38 per hectare per year), which represents 4.2% of the seasonal gross revenues of one hectare of rice. When the farmer is insolvent he cannot, or is reluctant to, pay the fees; these cases often concern poor and contract farmers. In the case of contract farmers, often the tenants pay regular rent to the landowner who then is reluctant, or refuses, to pay irrigation fees. As the local economic system works on the basis of the solidarity of all the farming families, cooperative members are obliged to pay off the debt of their defaulting members. If the repayment of the debt does not occur, conflicts may arise between the defaulting members of the cooperative and those who think that these defaulters are cunning free riders.

Under the administration of the MOB, the water fee recovery rate was low; for instance, over a five-year period (2008-2012), only €17,024 was recovered out of an average budgeted amount of €63,711 (a recovery rate of 27%). Although a farmer's water fee is still a marginal cost – for instance compared to

the costs of ploughing and fertiliser – it is still unaffordable for many smallholder farmers; in fact, disputes around water fees have persisted since 1998. A report from three development agencies (Global Water Initiatives, GWI; L'Union internationale pour la conservation de la nature, UICN; and International Institute for Environment and Development, IIED) mentioned discrepancies between the MOB and farmers on the modalities of water fee payment; while the authority of the scheme opted for the payment by cooperatives – reducing the risk of unpaid bills through the institution of the guarantee – farmers preferred individual accountability, which helps to cope with the challenges of mutual trust and associative life (UICN et al., 2010).

To illustrate the economic vulnerability of smallholder irrigators concerning water fees and to better understand the positions of the contending parties, it is important to present information on farm incomes and expenses related to the operation (O) and maintenance (M) of the scheme. To do so, I refer to a seasonal per hectare operating cost of rice farming that is designed from informants' experience. For a season, the following investments in inputs and labour are made: 400 kg of fertiliser (8 bags x 50 kg, about €33 per bag); for the first ploughing, occasional labourers are hired for €76, while the second ploughing costs about €53, and the water tax is €19. Apart from the cost of domestic labour (not systematically calculated), the average cost of production is €416, compared to seasonal gross revenues of €912. To cope with family food needs and expenses (health, rebuilding a wall or house, buying clothes, etc), one tonne of rice (equivalent to €229) is taken from the harvest (out of a total of 4 to 5 tonnes); one part is reserved for food and the other is sold for savings purposes. Thus, the seasonal profit for a local smallholder farmer is €267 per hectare.

As mentioned by most of the interviewed farmers, the constraints in recovering water fee are partly due to the low level of productivity. In fact, official reports from the MOB showed that since 1997 the rice yields have been between 4 and 5 tonnes per hectare (t/ha) per season, with a mean yield of 4.4 t/ha. In the same way, Bazin et al. (2017) showed that, according to the results of the feasibility studies, the yearly mean added value in Bagré is around €380 to €456 per hectare, compared to an expected mean added value of €760 to €912 per hectare. The poor performance of rice cultivation can be explained by the drainage problem, poor soil quality, the low quality of the irrigation scheme and its irregular upkeep. At Bagré, if farmers would like to live by rice cultivation alone they would need twice their current allocated area of developed land. To reach the food security and poverty security thresholds, each household needs, respectively, 1.2 ha and 2.2 ha plots (Bazin et al., 2017: 42). To deal with household expenditures, smallholder farmers diversify cash income opportunities to other agricultural and off-farm activities such as fishing, market gardening and trade. As stated by a Bisa farmer in a June 2015 interview,

On the basis of the operating costs, we do not get significant profits. When the seasonal productivity is good, the luckiest farmers can harvest between 5-6 t/ha. At the same time, the average is about 4 tonnes. Out of 100 rice farmers, those who harvest 4 tonnes are the most numerous. Some of them also can have 3 tonnes. (...) The current water fee is not too much for the one whose field produces well, but it is too expensive for the one who does not get enough money. We are even obliged to initiate many activities in order to live.

Since 2012, Bagrepole has faced the crucial matter of water fees, as did the MOB before it. Contradicting the farmers, the interviewed Bagrepole managers asserted that water fees are low compared to the O and M needs. In this context and based on a study of water pricing, Bagrepole plans to increase the annual water fee to €152 for both the old and the new schemes, which is 16.7% of total gross revenues for the same time period. The cost of the maintenance contract signed by Bagrepole in 2012 for the management and upkeep of the primary and secondary networks (tertiary networks being the responsibility of farmers) is calculated to be about €68 per hectare (Bazin et al., 2017: 29-30). These authors confirmed that poor farmers are in a poverty trap; they also confirmed that the involved stakeholders need to finance the upkeep of the scheme, as the current water fees are not sufficient to cover the O and M costs.

Although water fees seem low, they are unsustainable for smallholders who cannot live decently on only the income from rice cultivation because of their small plots and the low productivity of rice. Farmers thus consider the fee 'relatively high' and 'unfair', as well as accusing the scheme's managers of mismanaging the irrigation canal. Managers, on the other hand, blame some producers for practices that clog the irrigation canals and reduce their efficiency. Conflicts over water fees thus pit smallholders against each other and producers against managers. These conflicts are in addition to other issues, including opposition to collective payments, the amount of fees, the refusal to pay fees after bad harvests (as was the case with the producers of V3 in 2008), and the misappropriation of water fees by the leaders of some cooperatives. Conflicts related to water fees are thus set against a background of incompatibility of interests, overt disagreements, and conflict situations. As indicated, water sharing is based on sequential rotation within the irrigation scheme. The rules of water distribution are designed, applied and monitored by state engineers, with the participation of the leaders of the farmers' cooperatives; apart from perverse effects due to ecological imbalance or poor quality of infrastructure, rules were complied with and unequal access occurred in only a few cases. Water supply rules are supposed to guarantee the interests of the majority of producers; as rice fields are the same size and all farmers pay the same water fee, the prevailing principle in water pricing in the Bagré scheme is that of 'numerical equality' in the sense of Schnegg et al. (2016). This principle becomes distorted when some farmers are reluctant to pay water fees or when farmers try by illicit means to use more water than others who pay the same fee.

Like illicit diversion of water, cases of non-payment of water fees are considered by informants to be 'bad behaviour' which weakens organisational rules, shared moral values and mutual confidence among the farmers. Akin to what Schnegg et al. (2016) and Schnegg (2018) have labelled 'behavioural threats', such bad behaviour signals the likelihood of disagreements, disputes, and cold or overt/open conflicts.

### **Irrigators versus herders**

Conflicts between farmers and herders due to crop damage are the third most frequent kind of conflict (Table 1). With the enlargement of the hydro-agricultural space, grazing areas and rangelands have significantly been reduced. Investments were made for a pastoral zone in the surroundings, but despite the existence of this communal grazing land the livestock owners feel that the availability of water and good quality fodder remains a concern, mainly during the hot season. Herdsmen usually gather fodder around the irrigation channels and alongside the rice fields; animals thus sometimes invade and destroy rice crops, which is perceived by some smallholder farmers as an intentional provocation. Conversely, the Fulbe pastoralists regard the depletion of pasture and water resources and the uncontrolled expansion of agriculture as the main reasons for local conflicts over resources. While farmers resent the damage of soil and crop by livestock, in the Bagré Communal Development Plan (2014-2018) the most important constraints on livestock production were felt to be pasture degradation, qualitative and quantitative insufficiency of fodder, and the reduction or obstruction of the paths (tracks) and corridors by which livestock access pasture and water points (Commune of Bagré, 2013). As already mentioned in a case study of water management of the Upper Comoé River Basin by Roncoli et al. (2009: 705), the pastoralists from Bagré do not expect improvement in their situation because they are not considered to be a resident community and thus, compared to farmers, are underrepresented in local water decision-making bodies.

The pastoral mobility of Fulbe herders, which involves grazing their livestock near farmers' fields, is partly justified as a strategy to address the water and nutrient scarcity that accompanies their special containment. Most often opposing Fulbe agro-pastoralists and Bisa and Moose agriculturalists, resource conflicts present opportunities for antagonistic parties to manipulate ethnic differences in order to be compensated for crop damage and expand their control of resources; through mobilising their close relatives they are able to achieve these economic goals. Also, the economic benefits gained by the antagonistic parties seems to result in gains mostly for Bisa and Moose farmers because of their

demographic and political dominance. Along the same lines, previous studies on the resource conflicts in this region (Reenberg et al., 2003: 59), specifically in Bagré (Faure, 1996: 214-215), mention the recurring nature of the farmers versus herders conflicts as possibly leading to a deterioration in the relationship between the two groups and a degradation of trust and friendship. This affirms the fluid nature of conflicts over natural resources (such as water), which are likely to spread within local strategic and ethnic groups or at a regional level.

### **Up-scaling effects of water conflicts: cases of escalation**

Despite the infrequent occurrence of certain problems, water-related conflicts are fluid or insidious because they can potentially turn into ethnic, social, political or other kinds of conflicts, which can then contaminate other social spheres at small or relatively large scales. This potential expansion underlines the danger of increased intensity or worsening of conflicts. In 2001, for instance, after the death of a young Bisa in the royal court in Tenkodogo (allegedly because he had insulted the chief Moaga), a socio-political crisis arose<sup>5</sup> which affected the kingdom of Boulgou. This event constituted a turning point in the Boulgou socio-political landscape, with extensive protests being held by the Bisa people in order to contest the Moose's political dominance. This crisis in the capital of Tenkodogo's kingdom has had repercussions in Bisaku (Bisa country): Bisa communities have installed Bisa chiefs in each village-chieftom. This political turmoil, which is also prevalent in Bagré, has contributed to a deterioration in the social climate and increased conflicts related to the management of water resources, as made clear in this quote from a municipal worker in May 2015:

The coexistence between the different communities is no longer peaceful. Since every community has appointed his own chief, it became difficult to reconcile contending people from different ethnic groups. The Bisa clans sometimes threaten to withdraw land to those who do not pay allegiance to their leader (...). This situation has implications for rice cultivation. A misuse of words or a small bad behaviour can lead to a conflict. This also explains the conflict over the price of water that led to the arrest of protesters. It's really unfortunate, because we had to find other alternatives than arresting people because of the water.

Indeed, in 2013, protests by young people in Bagré were held in order to demand a reduction in the price of drinking water, which doubled following the installation of a private operator. The impossibility of finding a solution to the controversy that was acceptable to the stakeholders led to public demonstrations; these demonstrations led to violence between protagonists which resulted in the destruction of water infrastructure. The violence was ended with the intervention of the Gendarmerie (the police service of Burkina Faso) and the arrest of dozens of young people, who spent several months in prison in Tenkodogo; many of those who were injured in the clashes harbour bad memories of this water pricing conflict. After the election of a mayor who was a Bisa and a member of the ruling party (the Congrès pour la Démocratie et le Progrès, CDP), political rivalry between the CDP and the opposition party, the Union pour le Progrès et le Changement (UPC) increased and became a reason for further conflicts over water. As a young Bisa farmer testified in a May 2015 interview:

It's not solely because of the water. It's also a political issue. The conflict over water price was a consequence of the electoral conflict that has opposed the partisans of CDP and those of UPC. The price was generally perceived as expensive but most of the protesters were close to the UPC (...). The partisans of the opposition party have influenced the protesters who claimed that the Mayor was not good because he is responsible for the increasing of the price. If not, I think myself that it is so expensive to pay the barrel of 50 litres of water at €0,19; normally it should not exceed €0,09.

In this case, water pricing led to various events in local arenas. Local political entrepreneurs built their clientele by using this issue to instrumentalise ethnic identities; in the process it has become politicised and has exacerbated inter-community conflicts.

<sup>5</sup> For more details on this socio-political crisis, see Cissao (2018).

The economic stake and the density of social bonds between the stakeholders influence the intensity of water conflicts. Whether the economic value is low or high (crop damage) and the social ties are strong (family or co-ethnic ties), the water conflicts remain 'cold' – low intensity and less violent – and thus can be solved without high fees or negative outcomes for the parties. By contrast, if the economic value is high (crop damage, deviation of canal water) and the social ties are weak (agriculturalists versus herders, smallholder irrigators versus large-scale producers/agribusiness operators), the conflicts are more intense and violent; the violence in such cases can be intense and can occasionally lead to the use of weapons (for example, physical assaults with machetes) and the serious injury of protagonists.

When such conflicts emerge, and especially when they are made public, they can mobilise people within the social networks of the respective protagonists. The mobilisation occurs vertically (through rice growers' cooperatives, the rice growers union, ethnic groups) and horizontally (through social connections such as neighbourhoods). Rivalry over water uses and control are referred to as water-related conflicts when resentments are openly expressed by the aggrieved parties and when they involve or mobilise other actors or strategic groups that mediate or support the conflicting parties. Out of the eight forms of conflict escalation in natural resources management that were proposed by Yasmi et al. (2006), seven illustrate the observed characteristics of water-related conflicts: feeling anxiety (crop damage caused by cattle as a source of anger or grievance); debate and critique (the anger or grievance induces a verbal clash or quarrel and critiques of the weak focus on livestock or agriculture in government policies); lobbying and persuasion (by mobilising political allies, each contending party struggles for the recognition of his rights and for compensation); protest and campaigning (crop damage can lead to local farmer protests); access restriction (irrigators can impose restrictions on the use of water or nutrients by herders); court (stakeholders sometimes decide to appeal to state institutions for conflict resolution); and intimidation and physical exchange (threats and intimidation sometimes leading to machete fights between herders and irrigators).

The variety and recurrence of water-related conflicts in the Bagré irrigation system is illustrative of the 'tragedy' or 'drama' of the commons that is scrutinised in many seminal works (Hardin, 1968; Ostrom, 1990; Ostrom et al., 2002). I suggest that when water users choose to act according to individual rather than collective rationality, 'perverse incentives' (acceleration of water scarcity and conflicts) can occur in local ecological landscapes. The framing of water conflicts thus goes through a set of processes which includes the identification of inter-individual and collective struggles over moral and organisational values (group-centred values, fairness, compliance with norms, and loyalty among irrigators), as well as an assessment of the claims to, and power over, scarce resources inside and outside the irrigation scheme. This process requires exploring the intensity of the conflict, the stakeholders involved, and the way in which events as they occur influence the unfolding interactions between offending individuals or groups. The resolution of such conflicts seems to be a prerequisite for achieving the peaceful coexistence of farmers and sustainable withdrawals of shared water from irrigated systems.

### Understanding and managing water conflicts

Based on the quantitative data, three main dispute-brokering mechanisms were mentioned: interpersonal processes, locally based institutions (rice farmers' cooperatives or unions, ethnic leaders), and public agencies (the MOB and the Gendarmerie). According to statistical frequency (Table 2), rice farmers' cooperatives are the most common institutional interface for handling water conflicts and are used in 56% of cases. One is led to ask how the success and reliability of cooperatives in the settlement of conflicts can be explained. As testified to by a Bisa farmer, who is also a cooperative leader, in a June 2015 interview:

It is the water mismanagement that causes most of the conflicts. This is because whites [the civil servants and western developers] have come to confuse us. Anyway we must find internal ways in the concerned cooperatives or in the Union to manage conflicts. If the conflicts are related to water, we just apologise to



each other so as to preserve the local peace. We know each other over many decades. Both indigenous and migrants are bound by land agreements or loans and many types of reciprocal helps. We form a family, so we should understand each other. But if the conflicts opposed farmers to herders, the cooperative is responsible in accordance with the animals' owners to evaluate the crop damage in order to fix the fines to be paid by the animals' owners. If the damages are not important, for example less than €7, the victims and offenders can forgive each other.

As further confirmed by a group of women farmers in a June 2015 focus group discussion:

We experience water conflicts daily, but the rice farming leaders do their best to settle these conflicts correctly. Since most of these conflicts are due to water scarcity, we just need to well-organise the resource distribution to reduce or manage the conflicts. Rice farmers depend on each other. After all, local households live mainly from irrigated agriculture, our destinies are intimately linked; we are thus obliged to do everything to ensure peaceful coexistence between us.

Rice farmers are interconnected by diverse intra- and inter-generational ties established over decades through their family alliances, matrimonial exchanges, friendship relations<sup>6</sup> as well as exchanges of assistance inside and between families and lineages.

Table 2. Water conflict resolution forms (with 95% confidence intervals).

Resolution form	Frequency (n)	Percentage (%)
Farmers' cooperatives	32	56.1
MOB	8	14.0
Interpersonal negotiation	6	10.6
Farmers' union	5	8.8
Ethnic leaders	4	7.0
Gendarmerie	2	3.5
Total	57	100

Source: Personal data of G. Korbéogo.

Furthermore, for migrant households the 'institution of tutorat' (Chauveau, 2006) – whereby they are assigned a 'tuteur' or patron from the indigenous group who grants them land rights – guides their installation into the community; the patron-client relationship thus instituted is accompanied by moral obligations of reciprocity or mutual help, avoidance of disputes, and allegiance to their Bisa tutors, the rice farmers who were the original inhabitants of the area. The density of social connections between community members that is in this way maintained is helpful to cooperatives (whose leaders often have locally dominant social and economic capital) in efficiently dealing with their internal conflicts. As argued in the aforementioned quotes, in case of the failure of the cooperative to solve water conflicts, the farmers' representatives or the protagonists look to the union for conciliatory solutions. As a Bisa farmer and union board member declares in a June 2015 interview,

<sup>6</sup> The 'acquaintance volume' of an individual is evaluated on the basis of the people he or she knows and with whom they interact. In a society with a high volume of acquaintance, there is a broad channel of contacts that is useful in exerting influence on contending parties as well as swaying the opinions of those with whom they are in contact (de Sola Pool and Kochen, 1978). Thus, during the mediation of water conflicts, protagonists or mediators are more likely to find consensual solutions to conflicts when there is a high volume of acquaintance.

The water shortage causes conflicts but we manage to settle them quickly between us. The bindings that connect us are seemingly to the relationship between the teeth and the tongue: they are hitting each other, sometimes the teeth bite the tongue but they are forced to coexist. Our grandparents have been allies so currently we also continue to be allies and we wish that every time there is a consensus. Even, not less than two weeks ago, we even went together to settle a dispute between an old man and a young man from two cooperatives who were fighting over water access.

A Moaga farmer and community leader, in an April 2014 interview, says:

When a problem emerges, we try to find the right solution that will conciliate our common interest and preserve our social cohesion. It is the reason why most of the water problems between the cooperative members are solved in the cooperative, the Union or within the communities. If the conflict opposes two Bisa and they cannot solve it, they resort to us; but if it opposes two farmers belonging to different ethnic groups, a Bisa and a Moaga for example, the leaders of their community consult each other and meet the protagonists to solve conflicts. And most often it works. If the protagonists bring the problems to the official administration, they would not take into account the long-term alliance between the contending parties. As a consequence, they can fail to understand and to properly translate the farmers' problems in exact form and context.

The acknowledgment and fulfilment of the moral obligations<sup>7</sup> affects social relations. According to some members and managers of cooperatives, knowing some personality traits of disputants and how they compete for limited resources facilitates the resolution of water-related conflicts through locally based procedures. In this dynamic, it is noteworthy that disputes are settled with the collective ideal of preservation of social order and cohesion. As the general secretary of a public agency testified in a June 2015 interview, "We have never been asked to manage water conflicts. So, I do not know if people refer generally to the Gendarmerie. But I am sure they do their best to find internal solutions in order to preserve their cohesion".

In locally based procedures of negotiation or adjudication, there are fewer difficulties of 'translation' of the protagonists' narratives; in official processes of adjudication, however, informants complain about the 'mistranslation' of the facts or the 'misreading' of reality and the ignoring of social ties between the contending parties. Institutional mistranslation is mainly due to linguistic barriers between some state officials and illiterate farmers. This barrier entails interpretation and thus has in-built risks of bias and, according to interviewed farmers, can lead to falsification by institutional mediators of stakeholders' narratives about conflict issues. Moreover, conflicts arising from the violation of the rules for sequential distribution of water, from its low pressure, as well as from the non-payment of water taxes are handled through processes of negotiation; however, when the conflicting parties fail to find a satisfactory solution, the dispute is regulated through processes of adjudication by cooperatives, the union, and ethnic leaders. If a resolution is still not found, the case is transferred to the MOB or (after 2012) to Bagrepole, and finally, in rare extreme cases, to the Gendarmerie. Farmer-herder conflicts – frequently involving Fulbe agro-pastoralists and Bisa or Moose rice farmers – are typically resolved by ethnic-based representatives. Conflicts are transferred to the Gendarmerie in aggravated cases where there are large contradictions between the contending parties and where there is sometimes a refusal to pay the fines or an outbreak of violence. A Moaga farmer, in a June 2015 interview, states that

[i]n some cases, when one or the two parties disagree with our solutions, they refer to their communities' leaders or to the state representatives. They can transfer the conflict to the MOB or to the Gendarmerie, for

<sup>7</sup> This process of social integration creates the fabric of a 'moral community' which binds the members of that community or social group together around a common vision and wills, especially the maintenance of the peace and social order. In this sense, Tilly (1977: 3) states: "Building an all-embracing moral community also raises the relative costs of exit (...). If the resources are free of competing claims, if the action clearly defends the interests of every member and if the group is an all-embracing moral community, the probability of delivery is close to 100 percent. Loyalty is then at its maximum, the probability of departure or contestation - exit or voice - is at its minimum".

example in the cases of bloody or violent confrontations. This happens when the conflict implies important economic values or when it opposes the members of cooperatives to the rich farmers who divert irregularly the canal water for their farms.

As further described by a Moaga private agri-businessman, also in June 2015,

When there is a conflict between us and the cooperative rice farmers, they often use violence; destroy our facilities. We cannot accept that. So when that happens it is the state structures like the Gendarmerie or Bagrepole that can settle the conflicts. Sometimes, if the losses are enormous, we cannot accept forgiveness, it goes beyond simple amicable agreements.

In the same vein, in a June 2015 interview a gendarme describes the recurrent kinds of water-based conflicts and how his office settles them:

There are many water conflicts. But the most recurrent water problems are due to the fact that at the end of the season some farmers do not want to pay water taxes (...). We call people and we try to listen to them because there are some who will tell you that the season was bad or we did not buy my rice and so far I have not paid the money there. In fact, who go so far as to say good, I had input credits I have not paid yet (...). Well, all the cases that have arrived here, people make commitments even if it is little by little they come to pay up to pay (...). We collect money and we give it to Bagrepole against the signature of receipt (...). These kinds of cases must be treated with great diligence. If it's because people cannot pay the water taxes or pay the farm input fees that you put them in jail, you see that it discourages other producers (...). In the peasant milieu, if the Gendarmerie convenes a peasant or the police summons someone, it's a fear. In a second sense, if the other people hear that someone were summoned because he could not pay water taxes, in the village it is a shame for this person; so, people do their best to preserve their dignity.

Even if 70% of the fees remained uncollected (as was the case in the 2008-2012 period), this did not result in suspension of payment by the others; dialogue and conciliation continue to be preferred. As the state official pointed out in the above quotation, even despite legal pluralism and weak state institutions, sometimes water conflicts are managed by applying a combination of official rules and local values and ethics. In formal interviews and informal oral testimonies, peasant informants repeatedly quoted this sentence: "As long as the water does not get troubled, it cannot become cold". In other words, water is at the confluence of overlapping interests, therefore it crystallises various social conflicts (this refers to the potential of water conflicts to metastasize). As a vital source of life, water also mediates social relations and social peace-making (a reference to the metabolic power of water).

Research findings demonstrate that the strategies used to settle water-related conflicts include: 'forgiveness'; the instruction to respect the timing of water distribution in rice farms; informal arrangements for financial compensation for damages; 'withdrawal' (meaning that stakeholders do not initiate the solving of a conflict, with the expectation that the issue will resolve itself with time); and payment of fines set by public agencies. On the whole, the resolution of local water-related disputes satisfies 87.71% of the protagonists, against only 12.29% who declare themselves to be dissatisfied but accept the verdict for the sake of social cohesion. Because of their poor knowledge of official rules and institutional pathways of conflict management, farmers prefer to settle their conflicts through interpersonal arrangements or associational frameworks; this proves that this farming society has sufficient capacity to manage its internal conflicts, which is a sound basis for seeking social peace and resilience. The 'maintenance' of the common irrigation scheme in parallel to the 'maintenance' of social cohesion can help to achieve this goal. These findings support the work of Schnegg (2018), who pointed out that institutional multiplexity, specifically the social embeddedness of water institutions, reduces the necessity of wronged farmers to refer to formal institutions for conflict resolution. Social connectivity between the stakeholders facilitates the early detection and resolution of water conflicts and increases positive outcomes such as prevention of conflict escalation and its harmful social effects.

## CONCLUSION

This article has explored how water conflicts emerge and unfold at different scales, inside and outside of a large-scale irrigation scheme. It has demonstrated how water conflicts are regulated within different fora, including official institutions, community-based institutions and interpersonal negotiation. Understanding the historical and contextual signifiers of the water conflicts has contributed to highlighting the social background of the rivals and the stakes, as well as the tactics used to settle them. As evidenced by the empirical data, the mechanisms for solving conflicts depend on the type of conflict, the potential economic or social damage, and the social ties between the contending parties (family or ethnic relation, social alliance, neighbourhood, membership in the same or another cooperative).

This research reveals how conflicts arise when contradictions appear relating to the uses and rules of water. If some conflicts are related to material or economic stakes, others are due to non-material stakes such as a failure to comply with the community's shared moral values. Out of the eight escalation stages, seven were observed in the Bagré scheme; in the environment studied, there were no reports of movement to the eighth and last stage, 'nationalisation/internationalisation' through protests in international media and courts (Yasmi et al., 2006: 545). However, with the promotion of agribusiness and the potential interests of international investors, this last stage of conflict escalation could potentially be reached in the Bagré scheme in the future. As the conflicts over water resources occurred in the context of broader political economic and agrarian change, various factors can cause them to again arise and generate multifaceted consequences in the local and regional arenas. In small-scale irrigation schemes, conflicts mostly are confined to the reservoir area and its surroundings (irrigators versus bureaucrats, irrigators versus herders, irrigators versus riparian farmers) (Roncoli et al., 2009; van der Schaaf, 2008; Venot et Cecchi, 2011; Venot and Hirvonen, 2013). Also, in large-scale irrigation schemes the conflicts over water can emerge at the reservoir scale or from outside, and can reshape social relationships to water resources; specifically, conflicts in large-scale irrigation systems can spread over a larger socio-spatial sphere, with more significant effects, higher stakes, and involving a greater variety of strategic groups.

The occurrence and extent of conflicts depends on the nature and density of social ties between the protagonists associated with the economic value involved. Thus, when the social ties between the contending peasants are strong, the extent of the conflict is more circumscribed and its management less intense (first configuration). When social ties are relatively fragile or weak and the economic value at stake is relatively high, the probability of the conflict escalating and its management being onerous is high (second configuration).

In the first configuration, conflicts are primarily resolved in the course of interpersonal negotiations through acquaintance networks or local institutions (cooperatives, the union, or community leaders), with marginal involvement by state institutions. In the second configuration, by contrast, the protagonists (the more educated and wealthy or those with limited social capital) are more inclined to refer to official agencies to maximise their chances of winning the adjudication and being reimbursed for economic losses. Overall, local institutions have shown their capacity to manage water-related conflicts regardless of the social differentiation between protagonists, the extent of the problem, and the size of the stakes. By this logic, the choice of mechanisms of conflict management varies according to the cases presented: the stakeholders strategically use the opportunities of legal pluralism.

The prominence of farmer-based institutions is explained by the strength of the collective feelings and social interconnection among members of the cooperatives that arises from the pursuit of common interests, the sharing of accepted rules and values, and with having to deal with scarcity of water resources. This social cohesion contributes to the significant steering power of the socially embedded institutions, and these functional interdependencies enhance the formation of the social capital which is a key resource for conflict resolution. Thus, the cooperatives' members encourage the preservation of the strong social relations that help them face external contingencies and maintain social order. Despite

the plurality of the forms and roots of disputes, this paper argues that the existence of a collective will often helps to reach agreements or consensual compromises in the Bagré irrigation system. This participatory management could reduce free riding behaviours, increase equality, efficiency and sustainability, as well as enhance the legitimacy of local institutions and their representatives. As the Bagré scheme is ruled under an exceptional regime (*domaine d'exception*), there is a need for the democratic reform of water governance along the lines of the national water framework, one that will empower farmer-based institutions at the irrigation catchment level and beyond.

Finally, the article demonstrates how the construction of the dam and the adjacent irrigation scheme has contributed to reshaping social relations and the traditional ways of dealing with conflict. In addition to diversifying the uses of water and modifying the institutional architecture of its management, the construction of the irrigation system favoured the emergence of new institutions such as water management bodies and farmer cooperatives, which compete with traditional institutions in the management of water resources and its inevitable conflicts. Exploring water conflicts in a large-scale irrigation scheme therefore offers a fruitful perspective for highlighting the water-livelihoods-local politics nexus.

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