

Towards Sustainable and Inclusive Adaptation Interventions on Agro-Pastoral Dams

A case study in Northern Ghana

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List of Abbreviations

AF	Adaptation Fund
APD	Agro-Pastoral Dam
CBA	Community-based adaptation
CPR	Common Pool Resource
MESTI	Ministry of Environment, Science, Technology and Innovation
NGO	Nongovernmental organisation
SIM	Sustainability-Inclusivity Manipulation
UNFCCC	United Nations Convention on Climate Change
UN	United Nations
UWR	Upper West Region

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Executive Summary

Agro-pastoral dams (APDs) are an increasingly popular method of improving common-pool water supply for communities in West Africa, including Ghana. Both the international allocated funds for community-based adaptation (CBA) projects and the Ghanaian government itself push for further construction of APDs in northern Ghana to stimulate development of the livestock and agricultural sectors in rural villages. This is however not unproblematic, as the APDs are constructed in areas where culturally heterogeneous Fulani pastoralists and Ghanaian farmers compete for similar land and water resources and often are in conflict. Lifting open access water abundance is likely to change if not intensify these tensions in Northern Ghana, as the APDs serve to increase pressure on land use as both cattle numbers and area used for dry season farming increase as a result.

The question on how the continued construction of APDs can contribute to more sustainable water and land uses in contexts where culturally heterogeneous pastoralists and farmers compete for water and land is both practical and theoretical. Practical, because interventions would be much more efficient if they do not result in the current unsustainable APD uses and tension and conflict between water users. Theoretical, because current commons theory primarily associated sustainable commons management with culturally homogeneous groups that are able to exclude others from using their resource. The northern Ghanaian reality is the opposite, and new ideas are needed on how commons can be used and managed sustainably in such contexts recipient to adaptation interventions. In order to gain such ideas, this thesis proposes and uses the SIM (Sustainability-Inclusivity Manipulation) model, which complements current commons thinking on sustainability of commons use with issues of equity in climate change adaptation. The SIM model serves as an analytical framework which can be used to analyse the sustainability and inclusivity of commons usage of any resource. It ultimately serves to suggest on how external interventions can manipulate commons usage situations into becoming more sustainable and inclusive for different user groups.

The thesis employs the SIM model in a case study on 6 communities with APDs in an area within the Upper West Region in northern Ghana. The first main finding is that the APDs tend to be more sustainable if farmers exclude pastoralists from using the APDs. However, the SIM model overlooked that such sustainability of an APD imposes unsustainable externalities on neighbouring dams to which the excluded pastoralists resort. The second main finding is that if Fulani pastoralists and livestock owners are not limited in using the APDs and continue to expand cattle herds, this may lead to the collapse of dry season farming around these dams due to crop damage and/or water overuse. The third main finding is that the lack of sustainability of the studied APDs is primarily caused by a shortage of institutional supply.

Based on these results, the implications for current policy and practice are that community-based construction of APDs should be complemented with development of regional institutional arrangements. Local and regional arenas of discussion and deliberative dialogue between farmers and Fulani pastoralists are needed. The APDs should neither be open access nor rigidly excluding certain user groups to become more sustainable in the regional context. Regionally dynamic forms of inclusion and exclusion of Fulani pastoralists is needed. The implications on commons theory is that the current enabling conditions for collective action are not completely suitable to determine sustainability of the APDs in northern Ghana. They overlook negative externalities onto other CPR systems in the region due to pastoralist mobility. They should therefore not be seen as a blueprint to create sustainable commons usage situations, as the promotion of excludability of a resource and monocultural user groups are highly unrealistic and have unsustainable externalities in the rural West African regional context.

Introduction

In rural West Africa, farmers and pastoralists are often strongly exposed to changes in the climate due to their direct reliance on natural resources such as rainwater and pasture. Recognising this issue, numerous development projects have attempted to improve security of perennial water access by constructing agro-pastoral dams (in this thesis referred to as APDs or ‘dams’) in West African villages. APDs are basically dugouts open for public use, in order to provide water for both livestock and agricultural activities for one or several villages (Kpéra et al 2012). The APDs are constructed in order to support the rural villages in tackling poverty and adapting to the changing climate by stimulating the development of both livestock and crop production. APDs have been constructed since the 1990s, and fit within the popular trend in the community-based adaptation (CBA) approach for governmental and non-governmental project interventions. CBA interventions are projects deliberately designed and implemented to enhance/improve target communities resilience to impacts of climate change (Dodman & Mitlin 2011). CBA thereby assumes that the village or community is the proper scale to conduct interventions on to improve resilience to climate change in a participatory, bottom-up manner. As a result of the recent COP21 in Paris, more and more funding to help communities adapt to climate change is about to be released. This has and will trigger a plethora of CBA interventions aiming to create water abundance in the water-scarce areas throughout the developing world including West Africa. Therefore, CBA and other interventions that construct and/or rehabilitate APDs in West Africa are likely to be even more widespread in the future.

However, the establishment of APDs in West African communities is not unproblematic. The APDs are prone to degrade if not maintained well, and the newly available water attracts both farmers and pastoralists from the community and its surroundings that compete over using the water and surrounding land. As APDs are generally publicly accessible and it is difficult to exclude certain users, these can be considered common-pool resources (CPRs) or ‘commons’ (after Ostrom 1990). Competition over the commons is widespread in West Africa, often leading to conflict between farmers and pastoralists that compete over using publicly accessible land and water resources. For example, such conflict erupts when livestock destroys crops and farmers sometimes retaliate by killing cattle, leading to a breakdown of farmer-pastoralist relations (Williams 1998, Moritz 2006, 2010, Tonah 2002, 2006). Such CPR-related conflict also takes place along socio-cultural cleavages, where farmers belong to sedentary ethnic groups within national boundaries while pastoralists often belong to the widespread Fulani ethnic group. The competition over the commons is likely to be affected by CBA interventions on APDs as these lift water abundance in previously water-scarce areas. In these areas, conflict is not necessarily related to resource scarcity but rather to availability (Turner 2014). Competing claims and commons-related conflict is likely to continue, as groups of Fulani pastoralists continue to migrate southward and settle into the Guinea Savannah Belt as a result of degradation of pasture in the Sahel region (Turner 2014).

The problems of APDs with regard to sustainability in West African contexts where competition over the commons is tense are both practical and theoretical. Practical are the problems for CBA and other interventions on APDs on how these can have more sustainable results. There theoretical problem refers to the limits of existing commons theory. Commons scholars could have predicted the unsustainable and conflict-prone situation concerning APDs that emerged in West Africa, because there are two contextual characteristics they see to hinder the development of sustainable commons management. First, socio-cultural heterogeneity of groups using a commons is seen as an obstacle regarding sustainable governance of these commons (Ostrom 1990, 1994, Agrawal 2001, Bardhan & Dayton-Johnson 2002). For example, Ostrom (1990) demonstrated that irrigation projects in Sri Lanka

had many problems to improve cooperation between the ethnically and linguistically diverse irrigators in order to prevent overuse of the water. Second, commons theory proposes that commons users need to be able to exclude other people from using their commons in order to manage it sustainably (see Ostrom 1990, Agrawal 2001). And if some resource users cannot exclude others from using the same resource, Hardin's (1968) famous notion of a *Tragedy of the Commons* is likely to occur: a resource is inevitably overused by competing users up to a point where its supply collapses. Promoting socio-cultural homogeneity of APD beneficiary communities and their power to exclude others is however highly unrealistic and undesirable in the West African context if these interventions aim to be pro-poor and allocate APD benefits equitably. For example, when a CBA intervention installs fences around an APD with the aim to improve the water access for farmers by excluding cattle of Fulani pastoralists from using the dam and destroying the crops, the improvement in water supply of the farmers is at the cost of the pastoralists that previously also used the dam. As such, commons theory provides no insights on how CBA interventions that provide new commons abundance can contribute to more sustainable usage and management that includes culturally diverse user groups. Such an inclusive manner would fit better with both the pro-poor aims of CBA interventions and the West African context.

In an attempt to provide such necessary insights, this thesis employed a combination of the concepts of collective action and equity. Collective action, in this case the cooperation between common-pool resource users, is widely seen as a requirement for sustainable commons usage (Pretty 2003), and is used to rate the sustainability of different APDs. Equity, 'fairness' or justice in climate change adaptation refers to the equitability of allocation of intervention benefits (Thomas & Twyman 2005). In this research specifically, it refers to the degree to which different farmers and pastoralists are able to benefit from APDs. In this study, such equity in access to intervention benefits refers to the inclusiveness or 'inclusivity' of different APDs.

These concepts are combined into a theoretical model called the Sustainability-Inclusivity Manipulation (SIM) model. The SIM model diagnoses the different levels of sustainability and inclusivity of a commons, and can be used to analyse and suggest how CBA interventions can manipulate commons cases into scenarios where collective action and inclusion of different user groups is more likely. The SIM model is used to answer the research question on how CBA interventions that seek to rehabilitate or construct APDs can contribute to more sustainable dam usage and management that is less prone to result in dam degradation and tensions between farmers and pastoralists. Such knowledge is direly needed to prevent further degradation of existing APDs, and to prevent possible conflict between farmers and Fulani pastoralists related to the existing and new APDs to be constructed. In order to obtain such knowledge, this thesis analysed the sustainability and inclusiveness of several communities with APDs in Northern Ghana. The six studied communities are future beneficiaries of internationally funded CBA interventions that seek to (re)construct the APDs the coming years. By diagnosing the current APD systems in the studied region, suggestions can be made how the planned CBA interventions on APDs can have more sustainable and inclusive results than what has been achieved so far. The results therefore feed theoretically into commons theory, and practically into the implementation process of the planned interventions.

1. Theoretical framework

1.1 Collective Action for Sustainable Adaptation

In order to formulate a theoretical framework that is suitable to rate sustainability of commons and identify contributing variables, a diagnosis is needed about how the APDs in the area are governed. In this diagnosis, the concept of collective action can be used. Collective action is often defined as the coordination of efforts among groups of individuals to achieve a common goal when individual self-interest would be inadequate to achieve the desired outcome (Ostrom 1990). Collective action is used to analyse sustainability of the dams, as it is widely seen as a necessary requirement for successful and sustainable commons governance (Pretty 2003). Collective action is also seen as a requirement for adapting to climate change in developing countries in general (Adger 2010). CBA literature follows this line of reasoning, as CBA is based on the premise that “local communities have the skills, experience, local knowledge and networks to undertake locally appropriate activities that increase resilience and reduce vulnerability to a range of factors including climate change” (Dodman & Mitlin 2011). Undertaking ‘locally appropriate activities’ indicates the importance of collective action for communities which they need to adapt to climate change and to use their commons sustainably. Indeed, much adaptation to climate change occurs through collective action to mediate collective risk (Adger 2003), hence collective action may increase community resilience to climate change (Tompkins & Adger 2004).

Commons scholars state that there are several necessary preconditions to the successful implementation of collective actions associated with the design of institutions, the nature of the group, and the nature of the resource (Ostrom 1990, Brown et al 2002). Agrawal (2001) combined the most influential works in commons literature (which are Ostrom 1990, Wade 1988, Baland & Platteau 1988) and formulated a list of enabling conditions for collective action which needs to be adhered to increase the likelihood of successful collective action of commons users and managers. These factors include resource characteristics such as clearly defined boundaries, user group characteristics such as having shared norms and a small size. Furthermore it includes user-resource relationships such as a high dependence of the users on the resource, and a supportive external environment such as a government that does not undermine local authority (see left column table 1.1). With a focus on collective action, commons literature has been preoccupied with self-governance and the search for identifying factors that affect the success of communities themselves in governing their commons (Ostrom 2005, Van Laerhoven & Barnes 2014). However, in the context of areas recipient to adaptation interventions, the management of local commons is also influenced by state actors, international donors, NGOs and other community developers. Even when not formally mentioned in regulations and government policy guidelines and documents, many community developers are involved in supporting communities in governing their commons (Van Laerhoven & Barnes 2014). While the necessity of collective action for governing commons or other development aims through social capital building, capacity development, empowerment, participation and supporting community institutions has been recognized in participatory and CBA development projects, translating the findings of commons literature into intervention strategies is difficult (Van Laerhoven & Barnes 2014). It remains unclear to what extent external actors can support communities in governing commons sustainably. Van Laerhoven & Barnes (2014) recognized this issue, and decided for each enabling condition whether these can be manipulated with external projects such as CBA interventions (see right column table 1.1).

Enabling condition for collective action	Manipulability with external (adaptation) intervention
<i>1. Resource characteristics</i>	
(i) Small size	No
(ii) Well-defined boundaries	Maybe (mapping, markers)
<i>2. Group characteristics</i>	
(i) Small size	No
(ii) Clearly defined boundaries	No
(iii) Shared norms	No
(iv) Past successful experiences – social capital	Maybe (supporting the self-organisation related with other – less complex – issues)
(v) Appropriate leadership (young, familiar with changing external environment, connected to local traditional elite)	Maybe (providing leadership training)
(vi) Interdependence among group members	No
(vii) Heterogeneity of endowments	No
(viii) Homogeneity of identities and interests	Maybe (awareness raising activities)
<i>3. Relationship between resource system characteristics and group characteristics</i>	
(i) Overlap between user group residential location and resource location	No
(ii) High levels of dependence by group members on resource system	No
(iii) Fairness in allocation of benefits from common resources	Maybe (advice)
<i>4. Institutional arrangements</i>	
(i) Rules are simple and easy to understand	Maybe (advice)
(ii) Locally devised access and management rules	Maybe (advice)
(iii) Ease in enforcement of rules	Maybe (advice)
(iv) Graduated sanctions	Maybe (advice)
(v) Availability of low cost adjudication	Maybe (offering conflict resolution support)
(vi) Accountability of monitors and other officials to users	Maybe (advice)
<i>5. Relationship between resource system and institutional arrangements</i>	
(i) Match restrictions on harvests to regeneration of resources	Yes (providing science based information on regeneration patterns and the expected result of restriction rules)
<i>6. External environment</i>	
(i) Low cost exclusion technology	Maybe (depending on the context and the availability of such technology)
(ii) Central governments should not undermine local authority	Maybe (advocacy and lobbying)
(iii) Supportive external sanctioning institutions	Maybe (advice on how to match local sanctioning rules with existing external provisions)
(iv) Appropriate levels of external aid to compensate local users for conservation activities	Maybe (depending on the available resources at the disposition of the external organisation)
(v) Nested levels of appropriation, provision, enforcement and governance	Maybe

Table 1.1: Enabling conditions for collective action and their hypothetical manipulability with external interventions (Barnes & Van Laerhoven 2015, based on Agrawal 2001)

According to the list of conditions for enabling sustainable CPR governance above, Barnes & Van Laerhoven (2013, 2015) hypothesize that only some of these are possible to manipulate or ‘manipulatable’ by external interventions. For example, the factor that they see as most easily manipulatable is to improve the relationship between the resource system and institutional arrangements by matching restrictions on harvests to regeneration of resources. This can be done by providing science-based information on regeneration patterns and the expected results of restriction

rules. Factors that they do not see as manipulatable by external intervention are for example group characteristics such as the size and shared norms.

Making the distinction between manipulatable and non-manipulatable factors is useful: external interventions can then think of what to focus on in order to promote sustainable commons governance. However, as Agrawal (2001) noted when formulating this list, it is very likely that many of the identified factors are able to influence one another. Negatively, this may for example mean that a lack of shared norms may cause for example disappointing results when an NGO attempts to raise homogeneity in awareness and interests of resource users. Positively, non-manipulatable factors such as shared norms may be indirectly improvable by external interventions when these attempt to raise homogeneity in awareness and interests. This insight, however hypothetically, gives extra potential for external projects including adaptation interventions to support development efforts to improve CPR governance, while these causalities between such factors are hardly known as of yet. Indeed, general knowledge between the causal flows of the enabling conditions is as of yet absent and highly depend on context (Agrawal 2001). Arguably, such context dependence is also the case for whether the enabling conditions are manipulatable with interventions or not. For an Indian forest, which Barnes & Van Laerhoven (2013) used in their analysis, changing the size of the resource – a forest – is obviously difficult and a long term process. For a dam or irrigation system this is very different, as the intervening party can influence the decision process on the size of the dam, irrigation scheme and its user groups. Therefore, in addition to suggesting on how adaptation interventions in the studied region can contribute to sustainable commons governance through stimulating collective action, this thesis attempts to build knowledge on linkages between manipulatable and non-manipulatable enabling conditions for collective action needed for adaptation interventions and other commons-related development projects that aim to trigger collective action.

1.2 The Promotion of Exclusion and Cultural Homogeneity

The enabling conditions for collective action are used as an overarching set of indicators to determine the sustainability of each APD. These can however not be used uncritically as a blueprint, and two issues can be observed when comparing the enabling conditions for collective action within the context of adaptation interventions that create commons such as the APDs considered in this study.

First, these – not uncontested – factors associated with successful commons governance suggest that user groups should be able to exclude others from using the resource, as otherwise overuse and mismanagement may occur. The enabling conditions ‘clear group boundaries’ and ‘low cost exclusion technology’ clearly suggest the importance of exclusion of certain potential users. Exclusion from a commons by its current users is promoted, while inclusion of potential users that may hugely benefit in terms of adaptive capacity by using the commons is not considered. The importance of exclusion is logical, as when users of a commons are not able to exclude anyone else from using it as well, overuse or unsustainable use is likely as rules and sanctions are harder to enforce on an uncontrollable group of users. However, if such power of exclusion is promoted in the name of community empowerment under CBA interventions, the more vulnerable may end up being the ones excluded. In that sense, community empowerment concerning use and management of commons may be at the cost of equitable intervention outcomes and lead to very fragmented lifts in adaptive capacity. In Namibia, for example, marginalization resulting from a CBA intervention on a common water resource occurred, where borehole pumps and pipeline-accessing taps were installed and committees were trained to manage these water supplies during an intervention. After the intervention was completed, there were cases of exploitation and individuals having to work for local elites to gain access to these water resources when they were unable to fulfil monthly payments to the local water point committees

(Twyman et al 2002). CBA concerning common pool resources hence may promote exclusion of certain user groups from the commons, also in economically poor and rural areas. No suggestions are made how community-based governance structures can be better able to include multiple user groups, which is of prime importance for CBA interventions on commons if they aim to reach broad segments of communities including the most vulnerable. Promoting such exclusion is undesirable in development efforts aiming for equity and pro-poor solutions, as the excluded groups may both miss out on intervention benefits and become even more vulnerable as a selection of beneficiary communities members may gain exclusionary power over ‘their’ commons.

Second, apart from the promotion of excludability, commons literature often assumes that a considerable level of socio-cultural user group homogeneity is needed for successful commons governance (Ostrom 1990, 1994, 2009, Agrawal 2001, Bardhan & Dayton Johnson 2002, Dietz et al 2003). When drawing on this influential commons literature, the reality in West Africa with a lack of management of APDs and issues between farmers and pastoralists with divergent ethnic descent fit the ideas of these scholars, as they see cultural heterogeneity of groups using a CPR as an obstacle to collective action regarding commons governance. For example, socio-cultural heterogeneity such as differences in language among CPR users affects cooperative behaviour negatively (Bardhan & Dayton-Johnson 2002). The influential work on commons governance by Ostrom (1990) demonstrates that cultural homogeneity can facilitate cooperation by discussing case studies with mostly socio-culturally homogenous user groups, such as rather like-minded Turkish fishermen and Spanish irrigators. More culturally heterogeneous groups had more problems in governing their commons sustainably, such as the struggling irrigation-fed farming projects in Sri Lanka that aimed to involve several ethnic groups (Ostrom 1990 p.157). Bardhan & Dayton-Johnson (2002, p.7, 15) summarised the argument by stating:

“Generally, shared values or interpretations of social problems – cultural homogeneity – can facilitate cooperation in the use of the commons. [...] Social heterogeneity increases the cost of negotiation and bargaining inherent in the process of crafting [CPR] institutions, and severely limits the possible bargaining outcomes available to commons users”

As the enabling conditions for sustainable CPR governance tend to promote both excludability and socio-cultural homogeneity between users in governing commons sustainably, they tend to promote ‘adaptive clubs’. These are culturally homogeneous groups or ‘clubs’ that rigidly exclude others from using ‘their’ commons. The previously open access commons then becomes an exclusive club good (after Van Laerhoven & Barnes 2014). As these adaptive clubs adhere to some of the enabling conditions for collective action, they are likely to be sustainable, which includes being adaptive to climate changes.

However, promoting adaptive clubs with the enabling conditions runs counter to the reality in which adaptation interventions on CPRs are implemented in many economically poor countries. Rural regions using commons such as water and pasture may often be culturally diverse, where different ethnic groups may use similar commons for different purposes. In West African regions, there is widespread competition for land and water resources between sedentary farmers belonging to a different ethnic group than the Fulani pastoralists they compete with. Additionally, excludability of the commons is low as for example fencing of pasture and water points is too costly and excluding people from using previously open access water is often culturally unacceptable. It is often recognised that in such agro-pastoral contexts, the mobile, transhumant mode of livestock keeping demands a flexible tenure regime based on non-exclusive use rights to pasture and water resources (Beyene & Korf 2012). That said, considering homogeneity of users and excludability of commons, the West African

reality – and probably that of many other regions in economically poor countries – is differs strongly to what is proposed in commons theory, while it is often these contexts where adaptation interventions on commons such as water are widely implemented.

Promoting adaptive clubs with CBA and other interventions in such agro-pastoral contexts is not just unrealistic, but may also be costly and inefficient as these are hard to manipulate by outside interventions (see table 1.1). By applying the ideas of excludability to adaptation interventions, it is basically suggested that beneficiaries need to be able to exclude non-beneficiaries from accessing CPRs in order to govern it sustainably. If adaptation interventions aim to be pro-poor and include diverse groups to use and manage commons, promoting such excludability by socio-cultural homogeneous groups is undesirable, as it may come with negative externalities. Negative externalities can be the increased vulnerability of those excluded from using the commons, or overuse and conflict related to a commons elsewhere, when the excluded group resorts to using the commons there instead.

1.3 Equity and Justice in CBA interventions

Due to the possible problems resulting from the promotion of adaptive clubs in areas recipient to CBA interventions on commons, these need to be revised in order to better adjust the interventions to the context in which they take place. Also, knowledge is needed that gives insights on how to promote ‘adaptive commons’, which are not culturally homogeneous nor rigidly exclusive, but sustainable nonetheless. Such institutional arrangements would fit the West African agro-pastoral context much better.

The concepts of equity and justice in climate change adaptation provide a theoretical background justifying why adaptive commons instead of clubs should be promoted. Justice, or ‘fairness’ in climate change adaptation for this research focuses on distributive justice, which refers to the distribution of benefits of climate change adaptation interventions (Thomas & Twyman 2005). Equity in climate change adaptation then refers to such a distribution of benefits being spread equally or equitably among climate-affected groups. As Twyman et al (2002) demonstrated with their Namibia boreholes case study mentioned earlier, empowerment of communities in the name of CBA is not a simple recipe for the generation of justice and often desired equitable outcomes at community and household level. With the exploitation and exclusion of the vulnerable from accessing water made available with a CBA intervention, it is clear that policy which sees decentralization of resource management as the key to empowering local communities ignores possible adverse effects for equity in resource access (Thomas & Twyman 2005). As such, community-based resource management may in fact create differentiated access to resources (Agrawal and Gibson 1999, Leach et al 1999, Ribot and Peluso 2003). Therefore, the Namibia case study shows clearly that community management is not as utopian as is widely suggested in the community-based natural resource management and CBA literature concerning community level equity and justice in resource use and management (Thomas & Twyman 2005). As community empowerment may not reduce but increase inequality in access to the commons made available with adaptation interventions, community-based approaches including CBA may overlook the inequitable outcomes in resource access in natural-resource dependent communities. Indeed, issues of equity and justice in the context of climate change adaptation and related interventions have received scant attention on a subnational scale where potential winners and losers through differential access to resources may lead to highly differentiated adaptive capacities (Adger et al 2003, Paavola & Adger 2002, Kates 2000). Strong critics of communal and participatory approaches such as CBA, Cooke & Kothari (2001) stated that community participation in decision making about the use of natural resources may even beset a myriad of problems, and may not always

be in the best interest of either the target community or the natural resource being managed. Tompkins & Adger (2004) summarized the by stating that

“The creation of strong spaces of dependence, empowered communities, and high self-reliance does not automatically promote sustainable management or lead to the inclusion of the most vulnerable” (Tompkins & Adger 2004 p.8, based on Tacconi and Tisdell 1992, Pelling 2003).

While the limits to community-based approaches are now widely recognized in academia, a more fundamental question to ask is why equity in resource access is important for climate change adaptation interventions. From a commons theory perspective that seeks to promote collective action, increasing equity and justice in resource access may be undesirable as it may lift cultural heterogeneity of resource users and lower excludability of the resource considered. Equity may appear as a political (left-wing) preference to arranging resource access. However, it is frequently argued that adaptive capacity – the capacity of people to adapt to climate change – will be greater if social institutions and arrangements governing the allocation of power and access to resources within a community, nation, or the globe ensure that access to resources is equitably distributed (cf. Adger et al 2003, Tompkins & Adger 2004). As such, adaptive capacity is often regarded as a function of not only the availability of resources, but also of access to those resources by decision makers and vulnerable subsectors of a population (Smit & Pilifosofa 2003). Therefore, when nations or communities are more ‘entitled’ to draw on resources this greatly influences their adaptive capacity (Adger et al 2003). So while equity may be neglected in commons theory when diagnosing commons governance, issues of equity in resource access are of prime importance from the perspective of CBA interventions as these seek to strengthen adaptive capacities. It is evident that a component of equity should be included when analysing CBA practices on commons and formulating any recommendations regarding future interventions. Therefore, an in-depth analysis of commons in culturally heterogeneous areas requires an integration of issues concerning sustainability and equity. It implies that increasing the likelihood for collective action concerning a commons is not all that matters when implementing adaptation interventions. Also, the extent to which different potential users are entitled to the resource – i.e. are included in managing and using the commons – that opened up as a result of CBA interventions plays an important role in strengthening adaptive capacity.

In order to integrate the issue of equity to the research on sustainability of commons use, the second parameter of this research regards the degree to which equitable access is integrated in the groups of people managing and using a commons, referred to a parameter of ‘inclusivity’. Inclusivity encompasses the degree to which different (potential) resource users with varying socio-economic, socio-cultural and spatial-temporal characteristics are able to be involved in using and managing a commons. As adaptation interventions often recognize the importance of equitable resource access for adaptive capacity, they aim for equitable outcomes. Facilitating such an aim, this research does not limit itself to having theoretical implications for commons and adaptation theory. More practical suggestions are also made as to how adaptation practitioners can better integrate aims of sustainability and inclusivity in their interventions related to commons.

1.4 The Sustainability-Inclusivity Manipulation (SIM) model

In this research, the discussed concepts of sustainability and inclusivity in using commons are combined in a theoretical model called the Sustainability-Inclusivity Manipulation (SIM) model. The SIM model introduced here can be used to both rate the extent to which any CPR is used sustainably, and to what extent different users are able to use the resource. The sustainability of commons usage is based on the number of enabling conditions for collective action that are adhered. The inclusivity of the CPR usage is based on to what extent different users with varying socio-economic, socio-cultural and spatial-temporal characteristics are able to be involved in using and managing the common-pool resource (see 4.2 and 4.3 on how sustainability and inclusivity are indicated in detail). Based on how sustainable and inclusive a commons is used, the SIM model introduces a typology of four possible CPR usages.

- I. The first type is an unsustainably used resource from which potential users are excluded. As a low number of enabling conditions are adhered, the resource supply may be reducing due to degradation or overuse – making the resource use unsustainable. As exclusion takes place by people towards other people that aim to use the resource, the group using the resource can be called a ‘club’ (after Van Laerhoven & Barnes 2014). Such a resource usage type is characterised as a ‘maladaptive club’.
- II. The second scenario is a resource that is inclusively used as none or hardly anyone is excluded from using it, and can therefore still be defined as a commons. Simultaneously, its usage is unsustainable because its supply is reducing due to degradation, overuse or any other reason. This type of resource usage can be characterized as a ‘maladaptive commons’.
- III. The third possible scenario is a resource people are excluded from and only a selection of users can use it, while the resource is used sustainably. The resource is used sustainably, because various enabling conditions are adhered, such as sufficient maintenance and overuse is prevented. The resource usage type can be characterized as an ‘adaptive club’.
- IV. The last, probably mostly desired scenario by adaptation interventions, are commons that both include a variety of users and tend not to rigidly exclude certain groups, while the resource is also sustainably used. Such resource usage can be characterized as an ‘adaptive commons’.

Important to realise is that the typology of four CPR usages above are extremes, of which in reality intermediate forms may often exist. The SIM model with the four different types of CPR usage based on sustainability and inclusivity is shown in figure 1.1 below.

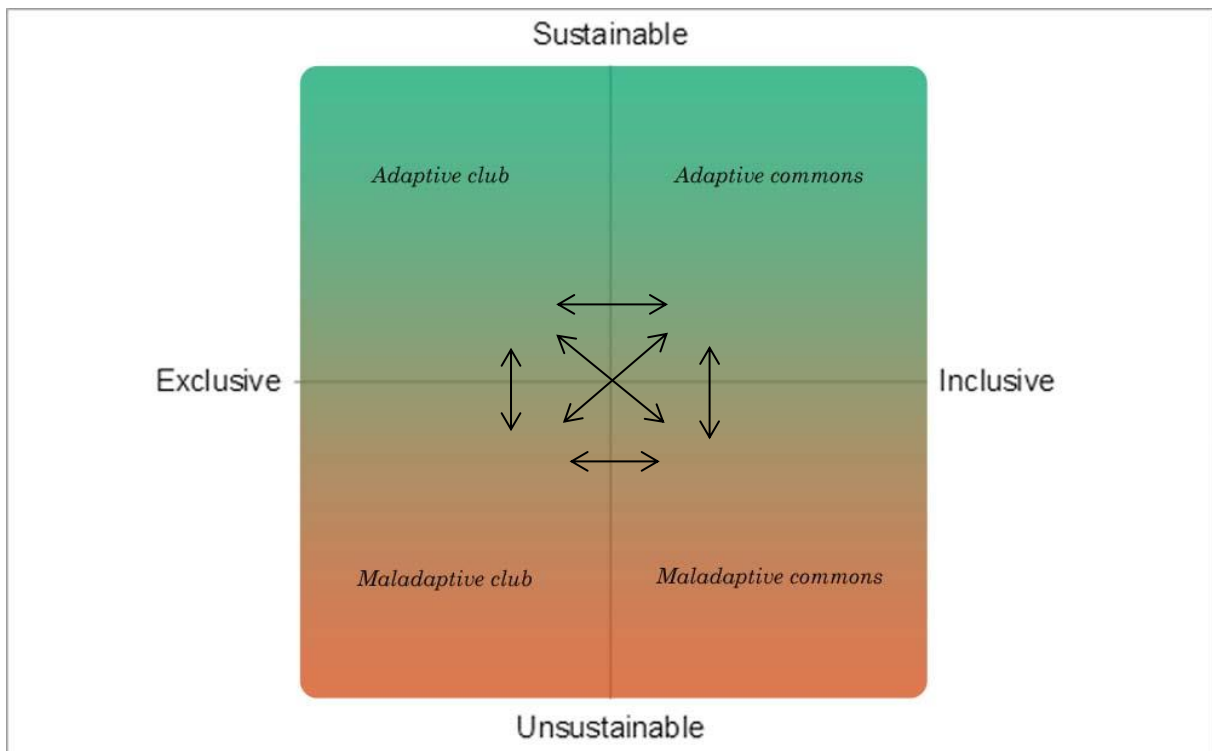


Figure 1.1: SIM (Sustainability-Inclusivity Manipulation) model distinguishes four types of CPR usages that can be manipulated with outside interventions (by author)

The sustainability continuum is placed on the vertical axis, and the inclusivity continuum on the horizontal axis. The first analytical step of the SIM model is to position every studied CPR – in this case several studied APDs – in the model according to their degrees of sustainability and inclusivity. Based on their place on the sustainability and inclusivity continua, every studied APD belongs to one of the four types with varying degrees.

The second analytical step of the SIM model is to determine to what extent and how the sustainability and inclusivity of studied CPRs can be manipulated with outside interventions. The ‘space of manoeuvre’ or ‘manipulability’ of the sustainability of CPR usage can be hypothesized depending on how and to what extent the (non)manipulatable enabling conditions for collective action are met (see theoretical part I). For example, if a CPR is overused because the users do not know how much of the resource can be subtracted before it degrades, an intervention can provide scientific information on how much maximally can be used. Inclusivity can be manipulated by changing to what extent different resource users are able to utilize the resource. For example, if a government wants to give access rights to a vulnerable group to a CPR that were previously excluded, a club usage type can be transformed into a commons usage type.

Therefore, every commons usage type can be manipulated from one type of usage to another under influence of an intervention, which is indicated by the arrows in the SIM model. In theory, a maladaptive commons type can be manipulated by external interventions into an adaptive club type. In reality, this could look like the enclosing of a commons and granting use and management rights to a certain user group. For example, the fencing of an APD and granting use rights to a certain village could transform an overused APD into a dam exclusively used by the village in a sustainable manner. With the help of an intervention, the usage type of the APD transformed into an adaptive club, sustainably using the water and excluding anyone else from other villages or seasonal migratory users.

Another possible path of manipulation is when an intervention aims to manipulate a

maladaptive commons into an adaptive commons. For example, an intervention could provide information on how many cows and farmers can use the APD's water without the dam drying up. If the users would act accordingly without rigidly excluding anyone, an adaptive commons can be the result. Or an intervention can aim to open up an adaptive club good into an adaptive commons. For example, by granting nomadic pastoralists limited access rights to water points from which they were previously rigidly excluded.

Interventions can also have more negative influences. An adaptive club good or commons can as likely be negatively manipulated into a maladaptive commons, which can lead to a well-known '*tragedy of the commons*' scenario where overuse is rampant (Hardin 1968). For example, this was the case during the 1960s in West Africa. The installation of open access boreholes in West African savannah areas that formerly knew strict traditional regulations on using the previously scarce water resulted in overgrazing of surrounding pasture (Williams 1998, for more detail see section 3.1). The type of water usage of the pastoralists in the Savannah was manipulated from an adaptive club to a maladaptive commons.

Based on where the studied APDs fit into the SIM model, suggestions can be made on how the newly planned interventions can manipulate the different APDs which are rehabilitated and reconstructed towards becoming adaptive commons. The suggestions also imply how maladaptive scenarios can be prevented. The SIM model can also serve to explore any relations between sustainability and inclusivity of APD usage in Northern Ghana and elsewhere. For example, it is as of yet hardly known whether APDs that are more exclusive are also more sustainable or not. Finally, transcending the studied context, this study reflects on the proposed SIM model as a theoretical tool for analysing common natural resources that are to be manipulated by outside interventions in general. The analytical steps that are conducted are structured according to the research questions, which are described below.

2. Research Questions

The main general research question is:

How can adaptation interventions on agro-pastoral dams contribute to more sustainable and inclusive commons usage?

The first descriptive sub-questions are:

- To what extent are the enabling conditions of collective action met for the different APDs?
- To what extents are multiple user groups included or excluded from using/managing the APDs?

This explorative question is answered in the first phase of the fieldwork, where different communities targeted by the AF are visited and users interviewed. Most dams age from 5 to 30 years old, and therefore recollections how institutional arrangements were and are made for collective action and to include and exclude user groups are expected to be known by its users. Once the descriptive questions are completed, the analytical questions are asked:

- Where does each APD usage situation fit within the SIM model?
- Which causal relations between the different manipulative and non-manipulative enabling conditions for collective action for the APDs can be observed?
- What relations exist between sustainability and inclusivity of the studied APDs?

After the analysis, the conclusive sub-question is answered. It transcends the study area, and touches on regional policy related to the APDs in Northern Ghana in general.

- What should the Ghanaian government and the AF undertake if the ongoing projects are to trigger more sustainable and inclusive usage of APDs in Northern Ghana?

The final two conclusive sub-questions touch on regional practice and theoretical reflection that also both transcend the study area.

- How can adaptation interventions on APDs in Northern Ghana and other similar regions manipulate usage into becoming adaptive commons?
- What are the strengths and weaknesses of the SIM model in determining sustainability and inclusivity of CPR uses and how to manipulate these?

The research does not claim to achieve all-encompassing knowledge to answer the conclusive questions, but provides some general insights based on the contextual knowledge gained. CPR issues are widespread throughout the world in a variety of contexts that fall within a spectrum of regions that are recipient to (adaptation) interventions that affect CPR usage in any way. Therefore, the knowledge is useful for further research and formulation of adaptation interventions related to CPRs in general.

3. Context

3.1 Northern Ghana: A recipient for water-related interventions

The research has taken place in the wider regional context of Northern Ghana of which the major part belongs to the West-African semi-arid Guinea Savannah belt. In Northern Ghana, climatic conditions are typical for the savanna region with high temperatures, a low and unreliable rainfall pattern and a long dry season when the area is affected by the *Harmattan* winds (Tonah 2002). The dry season lasts from November to April/May with high temperatures and marginal rains, and the wet season from June to October when most precipitation can be expected (Schraven 2010). Northern Ghana is the poorest part of the country, with up to 70% of people living below the headcount poverty line of \$2 a day (Coulumbe 2005). Subsistence farming is the main economic activity, and the major crops are yam, maize, cassava, legumes and vegetables. Most households keep small numbers of animals such as poultry, small ruminants and in some cases cattle (Tonah 2002). Livelihood adaptation is not novel in Africa including this region, where the natural-resource-dependent societies have been adapting livelihoods to a wide variety of external factors (Leach et al 1999) such as colonial and post-colonial governmental influences. In pre-colonial times, societies focused on ‘containing disturbances’ often through trial and error with varying livelihood practices (Beinhart & Coates 1995). By the colonial era, many such societies had to cope with external changes influencing their livelihood practices, such as governmental promotion of cash crop production. As from the 1960s post-independence era, people have been exposed to more and more interventions, from government, NGOs and other local and global institutions throughout Africa (Thomas & Twyman 2005). Such interventions have often been problematic, as customary structures considering commons access were not recognized while new resource abundance was provided for. For example, the installation of boreholes in pastoral areas in the 1960s served to open up remote pastures but also destroyed the basis of the social and institutional structures that previously regulated access to pastures. Before the boreholes were introduced, shortage of water and tight control on the little surface water available by local herders prevented the degradation of rangeland. When the boreholes were introduced, it was now possible for animals to graze for longer periods as water was no longer a constraint. Herders from outside were attracted by the boreholes and refused to abide by the old rules as the boreholes were considered state property. Free access to the boreholes led to an overload of animals that exceeded the carrying capacity of the surrounding rangelands. It led to rapid land degradation (Williams 1998), *a tragedy of the commons* as a result of interventions improving water supply. From the 1990s onward, APDs became more popular to provide rural communities in northern Ghana with water to use for irrigated farming livestock production during the dry season. Throughout Northern Ghana, irrigated agriculture and livestock production have been heavily promoted through the widespread construction of APDs and irrigation schemes in the rural areas as from the 1990s.

3.2 Cooperation and Conflict during the Fulani Settlement in Northern Ghana

The studied APDs in Northern Ghana are used by Ghanaian farmers and livestock owners, as well as pastoralists that belong to the Fulani ethnic group. In order to better describe the current context concerning commons use in northern Ghana, a brief historical description of Fulani settlement in Ghana and the governmental responses is now in place.

Since pre-colonial times, the Ghanaian farmers, livestock owners and Fulani pastoralists share a history of conflict and cooperation over common land and water use. Traditionally, the Fulani inhabit the Sudano-Sahelian region north of Ghana, in the countries of Mali, Burkina Faso and Niger. Since pre-colonial times and up to today, the Fulani have been on seasonal transhumance. During the dry season, Fulani herdsman migrate into the southern Guinea Savannah belt including Ghana, in search for pasture and water resources for their livestock. But during the recurrent droughts in the late 1960s and 1970s, pastures depleted and water for livestock became scarce in the Sudano-Sahelian region. In a response, groups of the transhumant Fulani pastoralists have been permanently leaving their traditional areas and settled in the greener southern parts of West Africa including Northern and Central Ghana (Bassett & Turner 2007). As such, there are two types of Fulani pastoralists in Northern Ghana up to today: semi-nomadic pastoralists seasonally on transhumance, and sedentary Fulani that settled down permanently. Unfortunately, there is no data available on the number of transhumant and settled Fulani in Northern and Central Ghana.

When the influx of permanent Fulani settlers started in Northern Ghana, the first relations between migrant Fulani and host populations were generally friendly and mutually beneficial. Fulani immigrants were allowed to settle down on the outskirts of village territories on the condition that they took care of the village cattle (Yembilah & Grant 2014). Once the Fulani households settled, they assist their family and friends in also settling in the area (Tonah 2002, 2003, 2006). Cooperation and economic exchanges developed and Fulani utilized their superior herding skills to benefit both groups (Tonah 2002). Local livestock owners contracted settling Fulani, and entrusted their cattle herds to Fulani herders who took their livestock to distant pastures in the dry season. The Fulani obtained milk from the animals, while Ghanaian livestock owners focused on farming. While the Fulani were required to take care of Ghanaian livestock to be allowed to settle down in, they were also able to build up their own herds (Tonah 2003). The permanent Fulani settlements in northern Ghana were and are usually located at the outskirts of villages, consisting of several huts arranged to form a single housing unit. A typical Fulani household consists of a herdsman, his wife or wives and their children living together in a compound. The man is responsible for the management of the household's and their hosts livestock (cattle, goats and poultry) while the male children take care of the day-to-day herding of the cattle. The wives and female children manage the home and milk the cows. During the rainy season, most households cultivate maize around the compound to meet a part of their food needs (Tonah 2002).

While initial relations were generally friendly, already early during the Fulani settlement some conflicts erupted between Fulani pastoralists and farmers. There was frequent damage to farms when Fulani moved cattle from the north to the south to the main market centres in the colonial period and immediately after independence. During the settlement in the late 1970s, the conflicts became more widespread and their relationship deteriorated. There was growing mistrust because of a series of livestock thefts by Fulani hired to take care of cattle owned by Ghanaian stockowners. Local farmers and stockowners accused Fulani herders of being responsible for the increasing prevalence of cross-border stock rustling, and therefore retrieved stock placed under their care (Breusers et al 1998, Tonah 2000). Also numerous conflicts arose from the alleged destruction of crops by cattle and destruction of

fruit trees and vegetation by Fulani pastoralists. This was one of the consequences of the more general expansion of human and animal populations in the hitherto sparsely populated northern areas which resulted in increased competition for resources between the two groups. Population growth in northern Ghana led to the fragmentation of village plots, forcing local farmers to areas formerly used by pastoralists. The competition became fiercer as the general environmental conditions deteriorated as a result of extensive farming practices, soil erosion, widespread bush-burning and increased deforestation (Bernadet 1986, Folly 1997).

When the conflicts continued and intensified during the late 1970s and 1980s, the Ghanaian government and its regional district assemblies (DAs) developed a particular negative attitude towards Fulani pastoralists. The settlement of Fulani in Ghana was consistently discouraged, and the central government and DAs have usually taken the side of indigenous farmers in any farmer-herder conflict. The government's reaction to conflicts was to expel the Fulani across the border to their supposed countries of origin in Mali and Burkina Faso. Generally, in governmental press releases, Fulani have often been portrayed as 'alien herdsmen' whose activities would constitute a nuisance for people and the environment, and they are would be a recalcitrant group that defies the authority of the state. During the 1980s, the hostile stance of the Ghanaian government towards Fulani resulted in military operations codenamed 'Operation Cowleg' and 'Operation Livestock Solidarity'. During these operations, the military and police were ordered to expel Fulani from northern Ghana and seize their cattle. The hostility led to a drastic reduction in the number of Fulani settlements in Northern Ghana. Those that remained resorted to unfertile grounds abandoned by farming populations (Tonah 2003). Despite the aggressive stance towards Fulani, the policy of expelling them was difficult to enforce. A sizeable proportion of livestock under their care belonged to Ghanaian stockowners and farmers who employed the Fulani to manage their animals. As Fulani that herded cattle owned by Ghanaians were allowed to stay, the attempts of expelling Fulani from Ghana was even counter-productive: it encouraged many Fulani herders to go into partnership with Ghanaian stockowners to secure their stay (Tonah 2003). Some of these stockowners were also local authorities, which made their role highly ambiguous: whilst having a strong rhetoric towards expelling Fulani they had also incentives to allow their stay.

In the 1990s, large numbers of Fulani pastoralists still sought to settle in Northern Ghanaian areas. As there were more restrictions on settlement, they generally had to consult the landlords (Tindamba), local chiefs, and the local governments (district assembly or DA). Permission was only given to those who agreed to leave the area in the case a conflict would occur with local groups. New Fulani settlers were not allowed to use the land acquired from the local landlords for farming until after an initial period of "acclimatization and good behaviour" (Rabbe 1998). Simultaneously, the cattle-numbers in Northern Ghana grew and competition for grazing areas intensified. Besides the ongoing conflict between the Fulani and Ghanaian farmers, the increasing activities of pastoralism coupled with the growing human population has resulted in environmental degradation, destruction of crops and unhealthy competition for natural resources (Tonah 2003). Strategies to gain access to pasture and water changed, and Fulani started to leave their animals in the field throughout the night. Up to today, this causes anger among local stockowners, complaining that the Fulani night grazing and cutting down trees leads to an overexploitation of the resources and causes degradation. Fulani pastoralists were also more often accused of being increasingly involved in cross-border stock rustling, with animals owned by local stockowners – obviously deteriorating the relation even more (Tonah 2003).

As of 2017, Fulani settlement is still not unproblematic, and in host areas there is dissent about the herders' influx and conflicts related to crop destruction, bush burning, tree cutting, and water use. Apart from taking care of 'village cattle', the settler Fulani use diverse strategies to secure their settlement in Ghanaian territories, such as offering some of their cattle to village chiefs and landowners (Yembilah & Grant 2014). Most of the Fulani settlers today are still regarded as 'strangers' or 'foreigners' no matter the length of their stay (Tonah 2002). Apart from the hostile governmental stance on Fulani, in reality there is a socio-cultural cleavage because the Fulani have very different cultural practices than the indigenous host populations in Northern Ghana. The Fulani way of life including their dressing, language, diet, pastoral specialization, residence pattern and religious beliefs are very different than other migrant groups and the host population in Northern and Central Ghana (Tonah 2006). The ongoing conflict between Ghanaian farmers and settled Fulani pastoralists cooperating with local livestock owners continues until today.

3.3 Ongoing ignorance of Fulani and establishment of APDs in Northern Ghana

Until today, the hostile though ambiguous stance of Ghanaian government towards the Fulani has hardly changed. Concerning new governmental development projects, the Fulani remain largely excluded in development and more recent climate change adaptation discourses of the Ghanaian government (Santpoort & Soeters 2017, unpublished). For example, in communication with the UNFCCC concerning the factors causing environmental degradation, it is stated that

"[...] negative factors influencing environmental degradation include; annual migration of Fulani Herdsmen [...]" (EPA 2011)" and "[...] the insufficiency of rangelands has also led to the creation of friction between the Fulani herdsman and food crop farmers in the country. Unfortunately overgrazing leads to desertification while especially large ruminants are sources of methane emission" (EPA, 2015).

It is clear that on the level of national policy making in Ghana, the Fulani pastoralists are generally framed as an unwanted burden that contributes to conflict and environmental decline on the national level. However, such rhetoric remains ambiguous in its enforcement on the regional level, as some of the livestock owners hire Fulani occupy regional government positions in decision making (Fielmua et al 2014).

While Fulani pastoralists are largely ignored in the development discourse of the Ghanaian government, APDs are a popular approach to boosting agricultural and livestock development by the Ghanaian government backed up by international donors. By no doubt, Fulani pastoralists also benefit from the improvements in water supply for cattle from APDs. Ghanaian President Akufo Addo launched a new flagship project in early 2017 called the 'One Village, One Dam' which aims to construct a large number of dams throughout Northern Ghana. The dams are meant to boost agricultural production, for which an equivalent of 20 million USD has been allocated in the 2017 budget statement (Ghanaian Times 2017). Other dams are planned to be constructed and rehabilitated by the Adaptation Fund (AF), an international fund that finances adaptation interventions set up under the United Nations Framework Convention on Climate Change (UNFCCC) as part of the 2005 Kyoto Protocol. At the time of writing, the implementation is about to start, and rehabilitation and reconstruction of new dams are scheduled over the course of 2017. As from April 2016, The Ghanaian Ministry of Environment, Science, Technology and Innovation (MESTI) has started the 4-year implementation of the AF-funded program *"Resilience to climate change in Northern Ghana through the management of water resources and diversification of livelihoods"* (available at adaptation-

fund.org). Roughly \$8.3 million has been provided by the AF for the program, which consists out of three components:

1. *Water resource management planning* which aims to “improve planning and management of water resources taking into account climate change impacts on surface and groundwater resources”. Roughly \$364.000 is funded.
2. *Community-level implementation of water resource management activities*, which aims to establish “climate resilient management of water resources by communities in Northern Ghana”. Roughly \$4.500.000 is funded.
3. *Diversification of livelihoods of rural communities*, which aims to, as it is titled, “enhance diversification of livelihoods of communities in northern Ghana”. Roughly \$2.250.000 is funded.

This research focuses on formulating suggestions both the “One Village, One Dam” project and the second AF project component above, as this component involves the construction and rehabilitation of APDs. The second component has several aims:

- To develop community water supply and management plans for 10 districts to incorporate climate change related risks (roughly \$217.000)
- To increase the water supply for multiple uses and users in 50 communities (roughly \$2.600.000)
- To install small-scale irrigation systems in 50 communities and water use associations to manage established and/or strengthened irrigation systems to improve efficiency and effectiveness of water usage under conditions of climate-induced water pressures (roughly \$1.079.000)
- to implement measures for water conservation under climate impacts, such as catchment/river bank re-forestation schemes in 25 communities (roughly \$422.000)
- to establish learning platforms and systems for integrating climate change-related risks into community management of water resources and livelihoods institutionalized in 10 northern districts (roughly \$177.000)

The most costly (\$2.6 million) and intensive project aim is the second one, which includes the construction and rehabilitation of boreholes, dugouts, dams, and rainwater harvesting. These can be seen as CBA efforts, as they are implemented on a communal scale in 50 recipient communities. The construction and rehabilitation of dugouts and dams, which are meant for multiple purposes such as dry season gardening and livestock, are most relevant interventions into which this research feeds. According to the MESTI proposal to the AF, there are already a large number of dugouts/dams across northern Ghana which have reduced in effectiveness due to siltation and structural disrepair. A total of 50 dugouts/dams are to be provided, with each having 2 to 5 communities deriving benefits from each dugout/dam (i.e. 2 to 15 thousand recipients per dugout/dam) (AF 2016). It is unclear as for now how the AF aims the dugouts/dams to be managed, apart from setting up water use associations for the irrigation schemes.

The popularity of APDs in Ghanaian development and adaptation discourse seems contradictory, as the APDs also provide water for (supposedly unwanted) settler and transhumant Fulani pastoralists. By providing more water, the AF proposal states that one of the resulting benefits is that it would “reduce social conflict among the stakeholders sharing the common resources especially among semi-mobile pastoralists and sedentary farmers because of increased availability of water and livestock

fodder” (AF 2016, p.44). By stating so, it perceives that increased abundance of common water can reduce conflicts between farmers and Fulani pastoralists. The MESTI motivated the need for AF money because otherwise “social conflict between different resources users such as between pastoralists and sedentary farmers will increase”, as well as “conflicts between crop and livestock uses” would take place, leading to “damage the social fabric in rural areas and exacerbate existing migration to urban areas, thus resulting in increased urban joblessness and poverty”. The MESTI request to the AF therefore assumes that conflict is caused by water scarcity, and that creating abundance is a recipe to reducing conflict between farmers and pastoralists. There is no evidence however that creating such water abundance may reduce conflict. As discussed in the second part of the theoretical framework, during 1960s previous efforts that improved water access through boreholes for pastoralists even fuelled degradation of pasture and conflict in northern Ghana. While conflicting resource use interests between multiple user groups of common waters are recognized in the AF proposal, there are no clear plans on how these heterogeneous users can be included and triggered to undertake collective action concerning APD usage and management.

3.4 The Study Area within the Upper West Region of Ghana

The Upper West Region (UWR) in Northern Ghana is among the poorest and most sparsely populated areas in Ghana. With around 700,000 inhabitants, the land is on average populated by 31 people per square kilometre and up to 70% of these people live below the poverty line of 1 dollar a day (Fielmua et al 2014). The rain water drains rapidly into the Black Volta, leaving the area without standing water bodies in the dry season when relative humidity is very low (Ghana Meteorological Department UWR, 2010). In these conditions, the region generally faces water stress for domestic and agricultural activities during the 7-month dry season. To improve water access during the dry season, the Government of Ghana and NGOs have been constructing APDs to promote dry season farming, animal watering and domestic uses (Alfred & Prosper 2014). In the UWR, a total of 84 dams and 54 dugouts exist and more are planned for construction (Namara et al 2011).

The land, mostly used for subsistence farming and cattle grazing, is owned by families and clans at the community level, and the landlords are the ‘custodians of the land’ (*Tendamba*) who manage it on behalf of the family and clan members. The chiefs are the general overseers of the community, and together with the landlords responsible for permitting the arrival and settling of Fulani herdsmen within their jurisdiction. In general, these local authorities comprising chiefs, elders and *Tendamba* usually consent to the settlement of Fulani pastoralists. When the Ghanaians own the livestock and recruit Fulani to herd the cattle, these authorities are usually well informed with the arrival of the herdsmen. Sometimes however, livestock owners engage herdsmen without the local authorities knowing. In such an instance, the herdsmen only respect the livestock owner and view them as above anyone else in the village, while the chief imposes sanctions on them and would prefer them to leave. This can be challenging for the local authorities however, as livestock owners may have regional political connections or occupy regional governmental positions themselves (Tonah 2003, Fielmua et al 2014).

Scarcity of water especially in the dry season has intensified the debate on pastoralism and their effects on water resources in the UWR. While there were several measures by the Upper West regional government to eject pastoralists as a way of resolving the rampant conflicts between pastoralists and farmers (Tonah, 2002), pastoralists are still residing in the UWR and the conflict between them and other actors continue (Fielmua et al 2014). Tonah (2002) argues that regional governments in the UWR are reluctant to take up the Fulani issue as they fear to displease the chiefs and other prominent persons that own cattle. Additionally, as discussed previously, some of the livestock owners that hire Fulani occupy government positions (Fielmua et al 2014). Around 2000,

when the local government of the UWR set up a task force to regulate the activities of pastoralism and prosecute chiefs who allocate land to these pastoralists, the chiefs saw this as local government usurping their role on whom to allocate the land to (Tonah 2002). Until today, chiefs and Tendamba continue to allocate land to Fulani pastoralists.

This study took place in a rural area within the recently merged Nadowli-Kaleo district in the UWR of roughly 450 square kilometres. Multiple agricultural and agro-pastoral communities live here, as well as a pastoral minority group belonging to the Fulani ethnic group. 6 villages are studied that all have an APD, which are mainly used for irrigation of crops, livestock, and fishing. All of the dams are constructed during the 1990s and early 2000s by externally funded projects, mostly by NGOs and a few by the Ghanaian government. The 6 dam communities in the Nadowli/Kaleo district are taken as a case study for several reasons. One, all the communities have an agro-pastoral dam used by multiple user groups, which are mainly dry season farmers and pastoralists. Two, the dams have been constructed relatively recently by external actors. The studied dams should obviously be funded by external actors and not locally, because this research focuses on issues of sustainability and inclusivity of usage of APDs established by external interventions. Three, the 6 communities are chosen because these are beneficiary communities of the AF. Their dams are about to be rehabilitated – or new dams will be constructed – by the AF interventions among the other activities listed the previous section within one or two years. One of the dam communities in the area (Sankana) is not incorporated in the research because they are no AF beneficiary community nor was there enough time to study more than 6 communities. These planned interventions will bring changes to common water abundance and perhaps management, therefore this research can feed into the implementation process of the AF and more future interventions likely to be implemented in Northern Ghana.

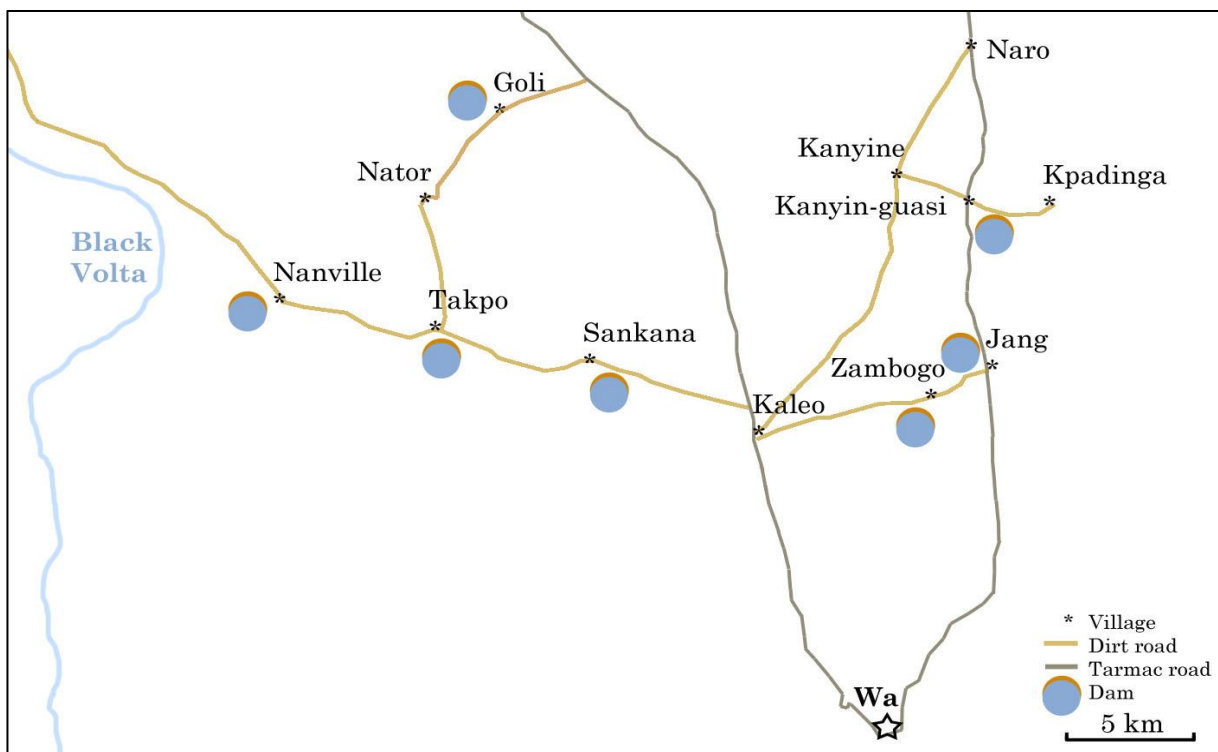


Figure 3.1: Map of study area (by author, based on Google Maps)

The studied villages are generally small, with 80 up to 625 households (see table 3.1), are generally located around 5 to 10 kilometres apart from each other and are connected through paths and roads (map 3.1). The regional capital Wa can be reached within one or two hours using a motorized vehicle from any of the villages. Most villagers rely on rain-fed subsistence agriculture for their food and also own some small ruminants such as goats and chicken. During the dry season, some women brew local beer (*Pitu*) and some groups of both men and women do dry season farming or gardening. They use the APDs or hand-dug shallow wells near the APDs where the water table is high. The relatively wealthy few in every dam village own some cattle and hire a Fulani pastoralist household, or run small businesses such as shops, a restaurant or a bar. Only these facilities are connected as of recently to an electrical grid, which has been installed in most of the villages in 2016 prior to the Ghanaian national elections.

Village	No. of households	APD construction – when by whom
Zambogo	118 (ALP 2015)	ProNet, 2012
Takpo	625 (ALP 2015)	GTZ, 1996. Rehabilitated in 2010
Kanyin-guasi	80 (est.)	GTZ, 1997
Nanville	220 (ALP 2015)	DA, 1999. Rehabilitated in 2015
Jang	600 (est.)	CIDA, 1991. Rehabilitated in 2015
Goli	400 (est.)	ASIP, 1998

Table 3.1: Studied villages with number of households and APD data

4. Methodology

In this methodological section, first the mode of theoretical analysis is explained. Second, the indicators used to determine the two parameters of sustainability and inclusivity of each studied APD are discussed. Third, ethical considerations and limitations in data collection and representation of this study are discussed.

4.1 Mode of Analysis: Situational Variables of User Groups

The aim is to understand the sustainability and inclusivity of APDs in a particular context which can be generalized to similar contexts. In that sense, the research focuses on inductive theory building. The research does not claim to find a panacea or ‘magic bullet’ to more sustainable and inclusive adaptation interventions on CPRs, but aims to understand complex contextual processes in which interventions take place. From this understanding both context specific and more general theoretical suggestions are derived relevant for literature and practice in CBA and other adaptation interventions affecting CPRs. Other than most case studies often discussed in commons literature (such as most famously in Ostrom 1990), this study focuses on a region where socio-economically and socio-culturally different user groups compete over similar resources. These are farmers and pastoralists belonging to different ethnic groups over APDs. An analytical perspective is used which takes the several APDs as a point of departure, and then determines who and which user groups use or attempt to use which dam.

This research does not adopt a communal focus, as community-based analyses are often criticized for being imagined constructs and may overlook intra- and extra-communal dynamics between CPR users (Williams 1998). Instead of (possibly unrealistically) seeing a community as a homogenous unit governing and using a CPR, user groups and potential user groups (people that are directly willing to use the CPR) are identified. These user groups may or may not be in line with one or multiple entities considered a “community”. For this study this is a more revealing approach, as user groups that do not belong to a community or are excluded from using a CPR may be overlooked in a community-based analysis. It is likely that if a user group is included or excluded from a CPR, this will affect the (existence of) possible spill over effects and competing claims on nearby CPRs. Effects are therefore regional. For example, the exclusion of pastoralists from accessing one APD is likely to divert them to use other water points in the region where they are not excluded from.

When analysing at any level, in this case regional, the analysis needs to keep the variables fixed at a deeper level for the purpose of analysis. Otherwise the structure of the problem would unravel (Ostrom 1990 p.54). By using the enabling conditions for collective action to determine sustainability of APDs in a region, a theoretical approach is adopted that incorporates both variables that are internal to local commons governance, and fixed variables that are external local commons governance. Internal variables refer to local institutional arrangements, while fixed external variables refer to the wider socio-economic and institutional environment affecting such local commons arrangements. Internal variables can be for example norms shared by dam users and the number of dam users, while an external variable is the extent to which a regional/national government allows for autonomous dam governance by users themselves. For this study, the fixed variables are the institutional environment in which the studied region is situated. This is obviously similar for all resource users in the region, which are the institutions that overarch village-scale institutions.

Both the fixed external and unfixed internal variables that determine sustainability and inclusivity are situational variables. Situation variables are contextual variables that are likely to influence indirectly how a CPR is governed, and can be derived when studying the context. This type

of analysis is in line with Popper's (1967) advice to place the primary weight of a theoretical analysis on the situations in which individuals find themselves. Accordingly, the mode of analysis of this research assumes that the situation, i.e. the context in which CPR users operate, strongly influences the institutional arrangements in place. As such, in this research situational variables are sought that have a high probability in influencing CPR arrangements and thereby sustainability and inclusivity of APDs. The preconditions for collective action are used to make sense of the contextual richness, which are basically a selection of situational variables that are likely to influence the sustainability of CPR use and management in any context. This contextual and situational approach is the opposite approach to when one studies internal, in-the-mind subjective variables, which by any means are more difficult to observe or measure (Ostrom 1990 p.38).

There are some limitations to the research as it focuses on situational variables concerning commons use and management. The approach may overlook two issues, which are first the subjective in-the-mind variables as discussed. These may affect the answers of respondents due to feelings of threat, insecurity and identity between culturally heterogeneous dam users. Second, the approach may underestimate the effect of possible physical limitations for the sustainability of the dams and irrigation schemes. The influence of physical variables such as a lack of rainfall, or a groundwater table that is structurally too low, can cause dam degradation and severely limits the water supply. These physical variables are not analysed, as this research limits itself to the social world concerning management and use of the dams.

Also, the results and suggestions made in this study cannot automatically be generalized for other areas because of the focus on situational variables. It needs to be acknowledged that methods for interventions creating enabling environments for both collective action and inclusion are likely to be different in different contexts. It is assumed that only by acquiring a diverse range of contextual knowledge, more universal suggestions can be made. So while acquiring knowledge on diverse contexts is out of the scope of this research, a contribution to universal suggestions can be made. It is thereby assumed that contextual knowledge for different commons types and situations is needed to determine how adaptation interventions affecting commons usage can stimulate both collective action and inclusion in general. By obtaining a part of such knowledge, this research contributes to the contextual richness of CPR systems in regions recipient to adaptation interventions affecting CPR usages and management.

4.2 Indicating Sustainability

In this research, the situational variables framed through the enabling conditions for collective action are combined with situational variables for inclusivity. Both are discussed in this and the next section. Sustainability of the APDs is rated using the enabling conditions for collective action concerning CPRs (see theoretical framework). Each dam is separately analysed as a CPR, and each enabling condition is reformulated to fit the regional dam's context. The operationalization of each enabling condition for collective action fitting the research context is demonstrated below (table 4.1). For the purpose of structuring the analysis, the indicators defining the parameters of sustainability and inclusivity serving the SIM model are answered dichotomously with a yes or no.

Enabling condition for sustainable CPR governance	Defined and operationalised as:
<i>1. Resource characteristics</i>	
(i) Small size	Dam size in which it is possible to exclude users, so that the size does not hinder the possibility of monitoring users
(ii) Well-defined boundaries	The users know what water body is part of the dam
<i>2. Group characteristics</i>	
(i) Small size	A group size in which communication between users is easily possible through group meetings
(ii) Clearly defined boundaries	Who is allowed to use the dam is clearly defined for all users
(iii) Shared norms	Presence of shared norms on how to use the resource and agreement upon these by the users
(iv) Past successful experiences – social capital	Presence of a feeling of trust/togetherness among dam user groups, and/or successful experience with communal labour concerning dam construction/maintenance
(v) Appropriate leadership (young, familiar with changing external environment, connected to local traditional elite)	Presence of a person seen by the dam users as a leader governing the resource, who has connections with local landowners/chief and government
(vi) Interdependence among group members	The way a user uses the dam affects the water availability for others.
(vii) Heterogeneity of endowments	Differences in economic assets between water users, where some can make investments for maintenance which lead to differences in access to the CPR
(viii) Homogeneity of identities and interests	People share a common identity and interests in usage of the dam
<i>3. Relationship between resource system characteristics and group characteristics</i>	
(i) Overlap between user groups' residential locations and resource locations	User groups can reach the dam easily on foot (as many people do not own vehicles)
(ii) High levels of dependence by group members on resource system	Users depend on the water to provide for their livelihood
(iii) Fairness in allocation of benefits from common resources	Users consider the benefits of the dam water to be fairly allocated.
<i>4. Institutional arrangements</i>	
(i) Rules are simple and easy to understand	Existing rules are understood by dam users
(ii) Locally devised access and management rules	Rules are devised by chiefs / other actors within the village and not by externals
(iii) Ease in enforcement of rules	Rules are currently enforced and there is ease in doing so.
(iv) Graduated sanctions	Sanctions are enforced that become gradually more severe when a user breaks a rule concerning water use
(v) Availability of low cost adjudication	The presence of adjudication in the region which is accessible for the users
(vi) Accountability of monitors and other officials to	Presence of monitors of dam and land use that are accountable to

users	users
<i>5. Relationship between resource system and institutional arrangements</i>	
(i) Match restrictions on harvests to regeneration of resources	Presence of restrictions on using water considering inflow rates
<i>6. External environment</i>	
(i) Low cost exclusion technology	Technology such as fences available that helps to exclude other users.
(ii) Central governments should not undermine local authority	No national or regional governments that overrule authority over dams and land by the village
(iii) Supportive external sanctioning institutions	Presence of police and a system of law enforcement that supports sanctioning of users
(iv) Appropriate levels of external aid to compensate local users for conservation activities	NGOs or regional government that support the users for conserving the dam
(v) Nested levels of appropriation, provision, enforcement and governance	Representation of dam users (dry season farmers, pastoralists, fishers, other users) in local dam committee. Arrangements within and between villages on water use with enforcement of rules. Recognition of intra- and inter-village arrangements with local government.

Table 4.1: Operationalisation of the enabling conditions of collective action

4.3 Indicating Inclusivity

The second analytical part focuses on the inclusivity of each dam, meaning in a broad sense to what extent are (potential) water users with varying socio-economic, socio-cultural and spatial-temporal characteristics allowed to use and be involved in managing and using the water. Socio-economic inclusivity basically refers to the socio-economic diversity of the dry season farmers using the dam. Socio-cultural inclusivity refers to what extent Fulani are allowed to use the dam and allowed to settle in the studied communities, and allowed to own cattle.

Socio-economic inclusivity is determined by analysing the socio-economic diversity of the dry season farmers. Socio-economic diversity is determined by whether they use chemical fertilizer, whether they make investments to maintain the water supply, where they buy their seeds, what crops are grown. Usage of chemical fertilizer is assumed to be used by non-poor farmers, meaning that the larger the number of farmers that use chemical fertilizer is, the smaller the number of poor farmers is assumed to be. The extent to which chemical fertilizer is used is then compared to the overall wealth of the community which is based on ALP (2015) data and own observations in the villages. If a large percentage of farmers use chemical fertilizer while a large percentage of the village is considered poor, socio-economic diversity of the farmers is considered low as the farmers tend to be the relatively rich. And vice versa, if only a few farmers use chemical fertilizer and the village tends to be poor, socio-economic diversity is considered higher as it better reflects the village's wealth distribution.

Socio-cultural inclusivity is determined by 5 variables: what number of Fulani families the community hosts, whether they are allowed to own cattle, whether Fulani from outside (settled in neighbouring communities as well as migrant Fulani) are allowed to use the dam, whether the dry season farmers are happy with their presence, and whether they prefer them to leave (see table 4.2)

Type of inclusivity	Operationalised variables
Dry season farming inclusivity	<ul style="list-style-type: none"> - Number of people compared to community populations using the APD - Number of farmers that sell their crops at the market - Number of farmer that use chemical fertilizer compared to the division of 'poor', 'middle' and 'rich' people in the respective community (according to ALP (2015) data) - Number of farmers that buy seeds themselves
Fulani inclusivity	<ul style="list-style-type: none"> - Number of Fulani that are settled in each studied community - Whether the settled Fulani is allowed to own cattle - Whether outside Fulani (settled in neighbouring communities/districts or migrant Fulani) are allowed to use the APD - Number of dry season farmers happy/unhappy with the Fulani using the APD and why - Number of dry season farmers that want the Fulani to leave and why

Table 4.2: Types of inclusivity and the respective operationalised variables

4.4 Research Process, Data Types, Collection and Analysis

The thesis work was conducted over the period from November 2016 to July 2017. An extended thesis was chosen, because of the extensive fieldwork required with both farmers and herders comprising an area of roughly 600 square kilometres. The 3-month fieldwork took place from early January to the end of March. The research intentionally took place during the dry *Harmattan* season, when the region was accessible with transport and inhabitants were not too busy with farming or cattle rearing activities yet. The research is limited to 3 months because of the onset of the rainy season in April, which makes the area hard to access and inhabitants are busy with farming and livestock rearing in that period. By limiting the fieldwork to 3 months, there was also enough time left after the fieldwork to finalize the thesis in early July. During the three months in the field, 6 villages with dams were studied, where every village took around 5 days to study. An additional 3 days were used to conduct participatory observation within a Fulani pastoralist household.

Qualitative data has been gathered as most of the enabling conditions – such as group characteristics or the external institutional environment – are variables of a non-numerical nature. The interviews were conducted in a semi-structured manner to leave the respondent some space to inform the researcher with issues outside of the framework (see appendix 1 for the various interview rounds and questions). Complementary to the interview data, a questionnaire was conducted on all farmers in the studied villages (see appendix III). Apart from providing significant data because of the relative high number of respondents (generally half or more of the total group of dry season farmers of each dam), this was also done to verify certain conclusions made from the interviews and to see whether these were in line with the views of most of the dry season farmers in the villages.

<i>Method</i>	<i>Number of respondents/sessions</i>	<i>Types and number of different actors</i>	<i>Gender division of respondents</i>
Interviews	34	2 local government officials 1 NGO district officer 1 chief 4 community unit committee members (of which 3 also dry season farmers) 12 Fulani pastoralists 5 dry season farmers 5 land owners (of which 3 also livestock owner) 4 livestock owners	2 Male Male Male 3 Male, 1 Female 9 Male, 3 Female 3 Male, 2 Female 5 Male 5 Male
Focus Groups	7	5 focus groups with dry season farmers 2 focus groups with Fulani pastoralists	32 Male, 12 Female 11 Male
Questionnaire	175	175 dry season farmers	91 Male, 84 Female
Participatory observation	1 session of 3 days	1 Fulani pastoralist household	2 Male, 1 Female

Table 4.3: Number and gender of respondents per data collection method

A variety of research methods was employed to collect the qualitative data (see table 4.3 above). Dam users (dry season farmers, Fulani pastoralists, livestock owners) and local authorities such as chiefs, landowners were targeted to collect data from because these were expected to have the most knowledge dam usage and management. Additionally, to analyse the local institutional environment, regional government officials at the district assembly and NGO district directors were interviewed. Interviews were used because these are seen as efficient in collecting the required non-numerical and in-depth qualitative data. Focus groups discussions were conducted with groups of APD users as this

may trigger discussion and a larger number of respondents can be involved more efficiently. In the North Ghanaian context, women and Fulani pastoralists tend to be more informative when communicated with in a group setting with other women or pastoralists which is why also for them focus groups were organized.

4.5 Methodological Challenges, Ethics and Limits

An important challenge for this research was to overcome the framing of partial realities resulting from a 'blame game' played by the different APD users. What happens? In Northern Ghana and the UWR specifically, resource users tend to blame each other for malpractices considering resource uses. Ghanaian farmers tend to blame Fulani pastoralists, and bush burning and tree cutting, and also for criminal activities such as armed robberies. Similarly, Fulani pastoralists often blame farmers for inflating their crop losses and the Fulani complain about the aggressive stance of farmers towards them and their cattle (Fielmua et al 2014). Fulani also tend to deny any crop damages and bush burning activities, let alone bribing and criminal activities. The resource uses and management data from interviews and focus groups may therefore be influenced as respondents can be tempted to deny these more controversial resource uses, such as bush burning, tree cutting, polluting water, and grazing on other people's crops. Instead, they may blame the other resource user group for such malpractices. As both groups tended to portray themselves as poor and vulnerable victims of their natural and social environment, it is assumed that combining the different stories can best reflect reality.

Apart from analysing the different points of view in order to overcome this methodological challenge of the blame game, extra measures had to be taken to receive more and better data from the generally reserved Fulani pastoralists. Because of the insecurity of their stay and non-involvement in any development projects in the area, their attitude towards non-Fulani and white people tended to be introvert, observant, careful and sometimes suspicious. In order to retrieve more and better data from the Fulani, a translator was employed that belonged to their ethnic group. Also, to build up more trust and have closer social contact with the rather reserved Fulani pastoralists, participatory observation within a Fulani family was conducted. I stayed with a pastoralist household for 3 days and participated in daily herding activities. This included finding pasture and herding the cattle towards a dam, which made me better understand the Fulani uses of pasture and water.

The blame game also brings ethical considerations for the researcher. At all times, the researcher attempted to stay neutral considering farmer-pastoralist issues and avoid choosing any sides in the conflicts that were taking place. The positive aspect of a neutral stance was that the interviewed farmers felt free to blame the Fulani for many issues, while the Fulani felt free to deny any of these accusations and blame farmers instead. The negative aspect of this is that the dam users never really were forced to be self-critical. The researcher had no evidence of any of the resource malpractices and violence to refer to when talking about the more sensitive issues. There was no proof of the several accusations of bush burning, grazing crops on purpose, robbery and rape supposedly done by Fulani and accusations of cattle killings and beatings supposedly done by Ghanaian farmers.

Another challenge was to achieve complete gender-neutrality when collecting data. For the dry season farmers there was no such issue, as they comprise both men and women, and the gender of respondents could be balanced by holding focus groups for either only men or only women. While dry season farming women were often in smaller groups and less dominant to be involved in the focus groups, some fruitful discussions with farming women could be held. Also the questionnaire on the dry season farmers almost had a complete gender balance in respondents.

Concerning the Fulani, it was much more challenging to include women in data collection. The herding activities, including using the APDs, are done by the men, which is why when Fulani

women were approached they immediately directed us to their father or husband. Fulani women also often did not feel comfortable to answer questions one to one with the researcher. Apart from cultural values that see the male household head as more appropriate to receive and talk with visitors, being a male researcher may have made it more difficult to talk with the Fulani women. This problem was partly tackled with two methodological solutions. One, some of the Fulani households were visited at times where the men were out herding the cattle on purpose, and only the women were left at the compound. However, only two Fulani women were successfully interviewed by doing this and others still rejected talking with me. The second solution was to invite the whole Fulani household to attend the interview – including the women. By including the wives and daughters, information could also be retrieved from them. This worked well, and some of the Fulani women were very enthusiastic in discussing some of the questions in such a family setting - improving the gender-balance of the data. Now that the methodological issues have been discussed, the following chapters present the empirical research results.

5. Results I: Sustainability and Collective Action of the APDs

The results for each enabling condition for collective action of the studied dams are discussed in this empirical chapter. The chapter is structured according to the list of enabling conditions presented in section 1.1.

5.1 Resource Characteristics

The enabling conditions for collective action are met for each APD concerning resource characteristics. All APDs serve 1-3 villages, where the size of the dam does not hinder potential for monitoring the users of the dam. The boundaries are also well defined, as for all the dams it is clear what water body exactly is the water belonging to the dam, and to what village the dam belongs.

5.2 Group Characteristics

5.2.1 Group size and clearly defined boundaries

Considering group characteristics, more differences can be seen between the villages. Group sizes are small for all dams, as they range from 1-3 villages, with 5-80 dry season farmers and 1-15 pastoralists per dam. The Zambogo dam has the smallest user group with 4 dry season farmers and 5 pastoralists (from neighbouring village Jang). Takpo and Goli are the larger dams, serving respectively 80 and 60 dry season farmers and each around 15 pastoralists from their own and two neighbouring villages. With these numbers, it is potentially possible to communicate through for example user group meetings, which is why group sizes are considered small.

For dry season farmers, it is clearly defined who uses the dam and who does not. As the groups of farmers are relatively small, the farmers know each other generally well and know who cultivates a plot near the dam. For pastoralists, these group boundaries are less clear. The Fulani that are hired to rear the cattle of livestock owners from the village where they were allowed to settle, they generally use the dam in the village territory they settled. The village Jang is an exception, as the dam is degraded and tends to silt up. During the dry season, the Fulani drive the cattle to neighbouring community Zambogo, where the dam is still able to provide water throughout the dry season. More often, Fulani settled in villages without a dam drive the cattle to neighbouring villages where there is one. This is the case for Kpaddinga and Naro, where the three settled Fulani families drive the cattle to Kanyin-guasi in search for water during the dry season. This increases pressure on the Kanyin-guasi dam, and it is silting up at the time of writing. Despite such issues, it is known in Kanyin-guasi what pastoralists use the dam. For Jang, Zambogo, Takpo, and Nanvilli the users from the respective villages do not know it as well, as the dams are less intensively used/monitored by the dry season farmers and pastoralists settled there. Fulani settled within a day's walk from these dams use them to varying degree for their own cattle and the cattle they are hired to take care of. The Goli dam is also more intensively monitored by the relatively large group of dry season farmers, and they are well aware which pastoralists use the dam.

5.2.2 Shared norms

Considering shared norms, which can be seen as an implicit or explicit agreement between dam users on how they should use it and who is allowed to use it, a different types of dams can be characterised. In all the dams, users from outside the village where the dam is located use it, often from neighbouring villages. However, in some dams the users in the village where the dam is located allow this freely (Nanville, Jang, Takpo), and in other dams payments are requested by the hosting village (Kanyin-

guasi and Goli). Where people are allowed freely to use the dam, shared norms are there as all accept each other in their dam use. Where payments are requested, the response of the outside village depends whether that norm is shared. If the payment is made, the dam users from outside the village accept the same norm considering requirement to use the dam. However, both Kanyin-guasi and Goli did never receive the payments, and the Fulani from outside villages responded by using the dam in secret early in the morning or at night-time. These dam users therefore have no shared norms, as the outside villagers stated that they do not consider it ethical or 'fair' to request payment from them for using water. Simultaneously, they are aware that the dam users living near the dam would not resort to physically excluding them as this would be considered immoral. Particularly Zambogo has no shared norms. As their villagers do not own the land where the dam is located, but the livestock owners located in Jang, pastoralists from Jang and other neighbouring villages (such as Jang-guasi and Kaleo) use the Zambogo dam freely, while the Zambogo community does not want this and are frustrated as crops often get destroyed and the dam is silting up due to intensive pastoral use.

5.2.3 Past successful experiences / Social Capital

Levels of social capital are mixed depending on dam user groups. Between dry season farmers, high levels of social capital (i.e. trust and a feeling of 'togetherness' with each other) are generally there. They are usually from the same village and extended families and work together in their dry season gardens. Between livestock owners this is a similar story, as they divide their land into sections where they allow their hired Fulani to settle. Between livestock owners and the dry season farmers, social capital is not always high however. Some farmers blame the livestock owners for hiring 'irresponsible' and 'reckless' Fulani to drive their cattle. Many dry season farmer men reported of armed robbery (Goli) and farmer women of cases of rape (Takpo). Social capital between the settled Fulani (usually 2-4 families per dam-owning village) and the (dry season) farmers is therefore very low. They do not interact, and most see the hired Fulani as intruders that cannot be trusted. Social capital between (dry season) farmers and livestock owners has also been lowering when the first Fulani were hired as from around 2010 in most villages. Especially in Takpo social capital between dry season farmers, livestock owners and the Fulani is very low and there are cases of mutual aggression, as in 2016 all dry season farms around the dam were destroyed by cattle driven by Fulani children.

5.2.4 Appropriate leadership

'Appropriate' leadership is seen as an important aspect for APD management by dam users in the villages. When asked for who is seen responsible for the dam, most farmers do consider local leaders elected for the dam/unit committees responsible for dam maintenance. Unit committees members are villagers elected to monitor the dam, alongside other activities which are mainly collecting taxes for the regional government and 'acting as policemen' as most of the villages do not have regular visits of police officers. Framed according to a trias-politica model, in local communities the unit committees are a form of executive power, where chiefs and elders (including the *Tendamba* and *Tindeme*) are the local legislative and judicial powers alongside the regional court. The unit committees are therefore not seen as 'powerful' themselves by other community members, or as they call it, as 'big men'. Judging by the wealth of unit committee members, this highly varies from illiterate elders in Nanville to literate and English-speaking youngsters in Jang.

Persons/institutions seen as responsible for APD maintenance	Number of dry season farmers that think responsibility lies with
Local government	6 (3%)
NGO	2 (1%)
Unit/dam committee	104 (59%)
Dry season farmers	15 (9%)
Landowners	32 (18%)
Missing	16 (9%)
Total	175 (100%)

Table 5.1: Persons/institutions responsible for APD maintenance according to the surveyed dry season farmers

Smaller groups think the dam is the responsibility of the local landowners (*Tindeme*) on whose land the dam is located or see themselves as most responsible or the local government (see table 5.1). This means that 9 out of 10 farmers do not see themselves responsible for dam maintenance, and think local leaders – mostly committee members and landowners – are the ones that have responsibility for dam maintenance. But to what extent is such leadership ‘appropriate’? According to commons theory the leadership is considered appropriate when the local leaders are ‘familiar with changing external environment and connected to local traditional elite’ (Agrawal 2001). In every village, in its traditional hierarchical structure, there were always people seen as local leaders, usually the group of chiefs, *Tendamba* (the ‘custodian of the land’ – explained in 3.1 and 3.2), *tindeme* (landowners), and the few relatively wealthy livestock owners. However, most villages these leaders were not actively involved in management of the dams. These local elites mostly thought that local governments and NGOs should help them out with dam rehabilitation as they lacked the funds. The elected dam/unit committee members did often not belong to the local elite group, while they are seen as responsible for dam management by the users. The committee members were to different degrees involved in dam management, and organized ‘communal labour’ in all of the communities to maintain and rebuild the dam in the past. All of them admitted that this was not enough to maintain the dam in the state it was in the first years after construction by NGOs and the local government. Their connections with the local elites did often not appear strong, as most unit committee members said they did not belong to the local leadership nor did they listen to them. Leadership is therefore not appropriate in most villages. The only exception is Goli, where the one seen as responsible for the dam was the maintenance is both a dry season farmers and belongs to the local elite. He is owner of the land upon which the dam and dry season farms are located. His leadership can be considered appropriate, as he strongly involved the village in dam maintenance and dry season farming activities while he has strong connections with the local elites and regional government.

5.2.5 Interdependence among group members

Interdependence among group members related to dam usage is low in all the villages. The irrigation systems constructed by NGOs would initially have lifted interdependence among the dry season farmers as the functioning of the furrows would affect all the farmers. This was not enough of a trigger to maintain such furrows however, as the pipeline under the dams mostly stopped supplying water due to the silting of the dam or water levels that became too low. When such water supply stopped functioning (usually within 3 years after dam construction) the farmers resorted to using buckets in order to water their plot. The buckets are either directly filled in the dam and carried to the plots, but in order to reduce labour intensity most farmers now dug shallow wells behind the dam next to their plots to fill their buckets, using the high water table. Nearly all farmers (95%) use buckets to water their

plots, while the remaining 5% uses pumps and pipelines. Using the dam directly or shallow wells lowers interdependence among farmers, as they only need to maintain/redug shallow wells usually used by 3-5 farmers instead of collective irrigation furrows used by all the farmers.

Despite that the farmers do not use collective irrigation systems, some interdependence remains as all rely on the same body of water – including livestock owners and fishermen. For example, in the village of Jang, the fishermen once decided to nearly empty the dam as they could make quick profit catching most of the fish. This caused anger among the farmers and livestock owners, who now enforce that opening the dam’s outflow to catch fish in lower water levels is no longer allowed. When the dams are relatively large, as in Goli and Takpo, such interdependence is lower as water is still highly underutilized and sufficient remains in the absence of rules so far.

5.2.6 Heterogeneity of endowments

Heterogeneity of endowments basically means differences in economic assets between dam users, however most common researchers specify this towards differences in access to the resource by the users. Generally, water access between dry season farmers is not very different, as almost all use buckets to water their plots directly from the dam or from shallow wells in the irrigable area. The dry season farmers using an APD nearly always reside within the nearby village territory, located from a few hundred meters up to a few kilometres away. Most walk to the dams, which is why the times it takes to reach the dam for dry season farmers is usually up to 15 or 30 minutes (see table 5.2) A group of men uses bicycles, and a few men use a motorbike while only 1 woman uses a bicycle. Accessibility to the dams therefore appears a bit better for men as a lower share of them walks to the dam – indicating some differences in access to dry season farming at the APD along gender lines.

Time it takes to reach the dam	No. of dry season farmers	Gender division
Up to 15 minutes	114 (65%)	57 women, 57 men
Up to 30 minutes	49 (28%)	22 women, 27 men
Up to 1 hour	12 (7%)	5 women, 7 men

Table 5.2: Time it takes for dry season farmer to reach the village APD

Mode of transport to the dam	No of dry season farmers	Gender division
On foot	150 (86%,)	82 women, 68 men
Bicycle	21 (12%)	1 woman, 20 men
Motorbike	3 (2%)	0 women, 3 men

Table 5.3: Modes of transport of dry season farmers to reach the village APD

Considering heterogeneity in water access for the Fulani pastoralists, the differences between Fulani pastoralists are high, as some live in a village where a functioning APD is situated whereas others need to travel to other villages with dams in order to access water. Villages without dams that host Fulani pastoralists are Kpaddinga, Nator and Naro (see map 3.1 in section 3.4).

Pastoral and agricultural water uses of the APD differ highly and are less straightforward to compare. A comparison is made by informing who benefits most from the dams according to both the livestock owners and farmers. By doing so it is assumed that if one is seen to benefit more from a dam than someone else, that person is probably able to utilize more of the water, indicating better water access. When asked who benefits most of the APD water, the dry season farmers thought the livestock owners benefit most. They thought so because the water is easily utilized by livestock, while water for irrigation remains highly underutilized. APD water is generally underutilized by the farmers because

of problems with infrastructure as discussed above, most importantly the silting of the dam blocking water from flowing through the pipelines meant to transport the water through the dam into irrigation furrows. The intense labour now required to water the plots using buckets instead discourages many potential dry season farmers, or lead to the abandoning of plots in some villages (Jang, Takpo, Zambogo). Therefore, the dry season farmers see the livestock owners as the main beneficiaries of the APDs in reality. Most of the livestock owners themselves also admitted they benefit most from the dam, as the abundant water which is underutilized by irrigators and cheap Fulani pastoral labour have given them opportunities to expand their herds since the construction of the dams. This points to a high heterogeneity of endowments between water user groups, however as both groups utilize the water differently the heterogeneity does not stimulate collective action: relatively wealthy livestock owners have no incentive to improve the irrigation infrastructure as they would not directly benefit from such investments.

When looking at the broader definition of endowments, meaning economic assets, considerable differences are also clearly within the dry season farmers. While actual wealth has not been measured in the survey, education levels and number of widows provide an indication. While most of the dry season farmers have not attended any education, twice the number of men have attended high school or more tertiary education compared to women. This indicates differences in socio-economic standing between educated (men) and uneducated (women) doing dry season farming.

Education levels	No of dry season farmers	Gender division
None	126 (72%)	66 women, 60 men
Primary School	16 (9%)	7 woman, 9 men
High School	29 (17%)	10 women, 19 men
Tertiary education	3 (2%)	0 women, 3 men

Table 5.3: Education levels of dry season farmers

	No of dry season farmers	Gender division
Uses chemical fertilizer	76 (43%)	45 women, 31 men
Does not use chemical fertiliser	99 (57%)	39 woman, 60 men

Table 5.4: Usage of chemical fertiliser by the dry season farmers

Interestingly, a gender division can be seen favouring women for chemical fertiliser. Slightly less than half of the total dry season farmers use chemical fertiliser, and of those who use it are a majority women (see table 5.4). How come? More than a third (36%) of the surveyed women do dry season farming because they are widows and rely on it for securing their food supplies. As they lose out on available labour and land of their former husband in rain-fed agriculture, the dry season farming is their most important source of food for them and their children as they do not have the food buffer from rainy season harvests. Because they are widows and relatively vulnerable due to a lack of stable subsistence rain-fed agriculture, slightly more than half (16 out of 30 widows) are involved in an NGO program to support them in dry season farming in Goli and Nanville. Iron fences and chemical fertiliser is provided, which is the reason why in total more women than men use chemical fertiliser. Such programmes do increase heterogeneity of endowments as it strongly increases access to use APDs for widowed women.

Another indication of heterogeneity of endowments can be given as the surveyed farmers have been asked whether some farmers are richer than others and make investments in the dam’s irrigation water supply. This is different for the villages, where in Goli, Nanville, Takpo and Kanyin-guasi most

farmers confirm that some are rich and make investments (for all villages 70% of farmers or more), whereas in Jang and Zambogo most indicate that this is not the case (also more than 70%). Especially dry season farmers in Jang and Goli demonstrated high differences in economic assets. In Jang, one dry season farmer, eldest son of the chief and seen as the “boss of the gardens”. He makes large profits growing sugarcane and uses a motorised tricycle as transport to move himself and a group of dry season farming friends conveniently to the dam site. Most other dry season farmers in Jang still have to go on foot and are not able to grow cash crops such as sugarcane. In Goli, the landowner holding the irrigable land behind the dam used his economic assets to invest in growing cash crops such as cabbage and tomato, and involved a group of widowed women from Goli in growing these crops together with him – again demonstrating a high heterogeneity of endowments. While the enabling conditions promote such heterogeneity in endowments, homogeneity in identities and interests should be more homogeneous. Whether this is the case, is discussed next.

5.2.7 Homogeneity of identities and interests

There are differences in the homogeneity of identities and interest, both between and within farmer and pastoralist groups. Identities, which the dam users define mostly as ‘tribe and community membership’, are similar for the dry season farmers and livestock owners as they mostly are from the same villages and are often related to each other. The Fulani however, hired to ‘take care’ of the cattle of livestock owners, are seen by the farmers as strangers and intruders having different cultural values. In the villages of Jang, Takpo and Goli farmers see the Fulani sometimes as criminals, and accuse them for stealing poultry, armed robberies and even of rape of women. In Jang and Takpo, farmers complained that the Fulani are a hindrance to their dry season farming activities, because their self-made wooden fences are not strong enough to keep the cattle out.

Such issues not only demonstrate differences in identity, but also in interests between dam users. The farmers aim to gain an income from dry season farming, while the livestock owners and hired Fulani seek to expand their herds by grazing intensively – also nearby dams and dry season farming plots. Livestock owners that hire Fulani often choose their side in issues of crop and fence destruction. One livestock owner in Takpo stated that “*most people just dislike Fulani for no reason, there is a stigma on them...*”. The interviewed Fulani pastoralists often show understanding that they are seen as intruders and strangers, with their ethical and cultural roots from north of the Ghanaian border. As such, they “live by themselves” and do not attempt to intermingle with the villagers, while they are settled on the brinks of community borders in the bush. Most of the Fulani are only settled 1-5 years, and speak a language different to the communities they settle in. Only those settled for several years or more are able to communicate with Ghanaian villagers in their respective local language. The Fulani women find some contact with villagers when selling milk in the rainy season on the market places, but apart from that mainly stay around their houses. Altogether, homogeneity of identities and interests are therefore high.

5.3 Relationship between Resource System Characteristics and Group Characteristics

5.3.1 Overlap between resource user's residential location and the resource location

There is generally a strong overlap between dam user's residential location and the location of the dam. As said previously, basically all of the dry season farmers live in the village from walking distance of the dam (93% of the farmers taking a 15 to 30 minute walk to reach the dam), as well as the Fulani pastoralists living on the brinks of the villages. But this is not always the case. Most of the dams are also used by Fulani pastoralists settled in villages without dams, located usually up to one day of walking from the dams (approx.. 12 kilometres maximum). All the movements of the Fulani pastoralists are mapped out below (see figure 5.1). Not only Fulani pastoralists from villages neighbouring to villages with dams move across community territory borders, but also across district borders. The Jang community experiences Fulani pastoralists from the Wa East district coming in during the dry season to use their dam, as water supply much more insecure in their district of residence. Such cross-communal and cross-district mobility of pastoralists lowers the overlap of dam user's residential location and dam location. The assumption of the enabling conditions that this has a negative influence on collective action and sustainable dam management is demonstrated by the village of Jang. While they are generally happy with the useful herding of their cattle by the Fulani settled in their community (see section 6.2, graphs 6.2 and 6.3), they complain about the Fulani coming in from Wa East from villages as "they do not know the chiefs and landowners good enough to make arrangements with". This also implies that making arrangements with Fulani pastoralists settled in bordering districts is currently challenging for the villages owning a dam.

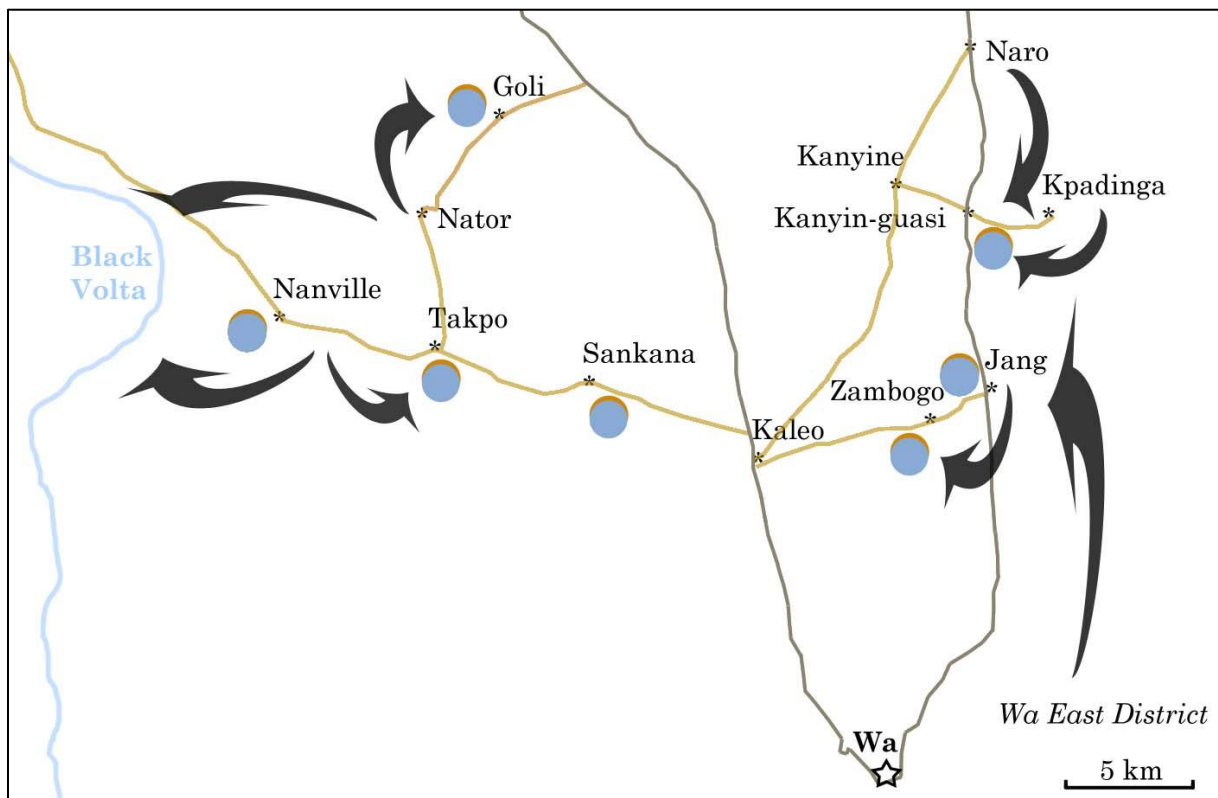


Figure 5.1: Map on Fulani pastoralist movement to reach water during the dry season (Based on Google Maps, by author)

5.3.2 Levels of dependence on the resource system

Levels of dependence on the dam highly vary within the farmer and pastoralist groups. While 19% of the dry season farmers indicated that communal labour was not enough to maintain the dam, none of them indicated that this was because the dam was not important to them. However, is it logical that the dam is more important to the dry season farmers themselves than to the relatively large group of villagers that do not use the dam directly. Within the group of dry season farmers, it became clear during the interviews that some completely depend on the dam to maintain their livelihood, especially widowed women lacking agricultural income during the rainy season. As widowed women are a relatively large group in the total group of farmers (30 out of 175 farmers, not incorporating widowed men), this lifts the general level of dependence on the dam. On the other hand, other farmer men mainly see an interest in the dam to grow cash crops, such as sugarcane in Jang. They therefore also easily give up farming, including maintenance of the shallow wells and the dam, when it is too labour intense and not profitable enough – contrary to the widowed women whose food supply relies on dry season farming.

Livestock owners and the Fulani pastoralists also highly depend on the dams, however they have more ‘escape options’ if a dam stops functioning – they are mobile enough to bring cattle to another neighbouring dam that still functions. For example, during the participatory observation with a Fulani pastoralist around Jang, he brought the cattle to the Zambogo dam as the Jang dam almost dried up near the end of the dry season. As demonstrated on map 5.1 above, pastoralist movement to functioning dams occurs all across the studied region, and is based on the distance of the dam to the pastoralist compound and the water available in the dam.

5.4 Institutional Arrangements

5.4.1 Fairness of allocation of dam benefits

Fairness of dam benefits is a debatable enabling condition for sustainable dam governance, which cannot be as directly measured as the conditions discussed so far. Fairness is a subjective value which can vary in definition between dam users and with outsiders such as the funding and implementing parties of dams. According to the dry season farmers, the benefits of the dam are distributed fair (174 out of 175), pointing towards a high fairness in allocated dam benefits. However, when defining fairness differently to whatever the dry season farmers think, the allocation does not have to be considered fair at all. Theoretically, fairness is highly related to the issue of distributive justice, which refers to what is distributed, between whom they are to be distributed, and what the proper distribution is (Miller 1992). In the context of climate change adaptation, distributive justice or fairness relates to the distribution of benefits and adverse effects of climate change across society (Thomas & Twyman 2005). The distribution then often seen as ‘proper’ or ‘fair’ in the institutions that fund and implement adaptation interventions is a distribution that minimizes vulnerability to climate change of those most vulnerable. Those most vulnerable are often the poorest, and such a definition of fairness results from the principle of equity represented in the UNFCCC and other institutions determining the climate change adaptation agenda (cf. Burton et al 2002).

Distributive justice or fairness in allocation of dam benefits is high according to the dry season farmers, because they do not consider it unfair if some benefit more than others. This means that they do not adhere to the principle of equity in benefit distribution as strong as donors and implementing parties of adaptation interventions often do. When asked who benefit most from the dam, most dry season farmers said that the relatively wealthy livestock owners benefit most because they can utilize the dam effectively to raise their cattle numbers within a few years. Also most of the interviewed

livestock owners themselves admitted this, as the dry season farmers have not able to utilize the water for irrigation as intensively. So even though the dam users consider the distribution of dam benefits fair, defining fairness as an equitable distribution of benefits, it cannot be considered as such.

5.4.2 Rules are simple and easy to understand

Complexity of rules is currently not an issue because complex rules do not exist concerning the dams. Rules are mainly set up by the local chiefs and landowners in response to incidents. In Goli, the landowner of irrigable land behind the dam, who is also a dry season farmer, restricted Fulani pastoralists from grazing near the dry season gardens after several crops were destroyed by cows that wandered off. In Kanyin-guasi, the livestock owners are responsible to contribute funds for dam repair when it is silted or leaking, which happened twice the last 5 years. The size of the contribution depends on the number of cattle they possess, the wealthier livestock owners hence contribute most as they use the most water. According to the unit committee leader, the responsibility for maintenance rests with the livestock owners as the dry season farmers are ‘poor and not commercial’ and it is therefore not seen as fair to request contributions from them.. In the other villages however – Zambogo, Nanville, Jang and Takpo – there are no such or other rules at all. Overall, it is therefore clear that the few rules are simple and easy to understand.

5.4.3 Locally devised access and management rules

Locally devised access and management rules differ per village. As just noted, only in Goli and Kanyin-guasi there are some rules on dam access and management, such as areas of irrigable land restricted for livestock access and maintenance payments based on cattle ownership. For all dams, permission of the person owning the land where the dam is situated is needed in order to start a dry season plot, which under normal circumstances is given to anyone from the respective village. Also some rules exist on where plots can be located, primarily locating them downstream of the dam instead of upstream, as upstream plots are harder to irrigate and may release chemicals into the dam’s water reservoir. This rule and rules on which pastoralists can access the dam are locally devised and enforced in some villages – again in Goli and Kanyin-guasi – but not in others (Zambogo, Nanville, Jang, Takpo). Chiefs and landowners do however have the authority to devise local rules, which may happen after incidents. For example in Jang, a dry season farmer said that

“Last year we ran out of water, because someone opened the irrigation pipe during the rainy season. When we realized and closed it, the rainy season was almost over. Someone did it to fish the water, someone from the community around the dam. They could not find the person, and the Tendamba cursed him. If the person does it again, it should not survive”

The generally strong belief in the effect of curses can help in enforcing rules and preventing offenders to break rules again. But other enforcement is more challenging, as discussed next.

5.4.4 Ease in enforcement of rules

Despite the effect of curses that a *Tendamba* can apply, enforcement of rules is troublesome for all the villages. The villages of Goli and Kanyin-guasi, where some clear rules are set up, both have difficulty enforcing these rules. In Goli, according to the owner of the land around the dam and dry season farmer himself, the Fulani pastoralists often let their cows come too close to the gardens. During one of the interview sessions on the Goli dry season farms a cow indeed wandered off onto the gardens and attempted to graze on some of the crops. According to the farmer it happens because the Fulani boys are lazy and do not care about the farms – however during participant observation it became clear that it is sometimes difficult to control the cattle when they are large in number and desperate to find pasture during the dry season. As a solution, the landowner in Goli established a ‘guarding post’ (a chair under a palm tree) where he remains seated throughout the day in between farming activities to keep an eye on occasional cattle that may wander onto the farms. In Kanyin-guasi, there are difficulties in enforcing their rule on payments that have to be made by livestock owners from a neighbouring village, Kpadinga, who also use the dam. At the time of writing such requests are still being made, and the Kpadinga livestock owners keep on refusing because “water should be free” and because “they have the same ancestors”. The Fulani families that drive their cattle said that there is no option for them to find a different water source, as these are difficult to reach within a day. As a solution, they admitted that they still use the Kanyin-guasi dam – at night or very early in the morning so no one will chase them away. The Kanyin-guasi villagers see no option to sanction them, because “they are all the same”, meaning they are from the same ethnic group and many are related through family lines and know each other well. At the time of the fieldwork, Kanyin-guasi was attempting to make arrangements with Kpadinga but the results are uncertain.

An important rule in all the villages is that a livestock owner should compensate for the costs concerned if his cattle has destroyed crops of a farmer. Compensation can be paid in money, crops, or animals. Crop destruction is a widespread problem, as over a third of the surveyed farmers had their crops destroyed in the last few years (61 out of 175). Of these people, nearly all (57 out of 61) stated that they were not given sufficient compensation. When asked about this problem, they stated that crops often get destroyed either by family members who cannot afford to pay them compensation, or by Fulani cattle who refuse to admit that it was their cattle that destroyed it. Enforcing the rule of crop compensation therefore hardly happens in the studied area.

5.4.5 Graduated Sanctions

Graduated sanctions are absent in most villages. Sanctions concerning dam use are not applied, both because there are simply not a lot of established rules and breaking the few existing rules usually does not result in sanctions. The absence of sanctions is related to dam ownership. As the dams are funded by outside NGO or government funding and often constructed by local contractors, the communities themselves often do not see themselves as owners of the dam. The dam may be situated in their village, but neighbouring villagers do not have less right to use it. Kanyin-guasi is an exception in this, as the villagers were required to contribute a small amount of money for the construction of the dam. The German NGO GTZ (*Deutsche Gesellschaft für Internationale Zusammenarbeit*) requested all Kanyin-guasi men of above 18 to contribute an equivalent of 3 USD for the construction of the dam. Perhaps a symbolic amount, but the contribution may be the reason why in Kanyin-guasi a stronger sense of ownership is established and leading to the requests of contributions from Kpadinga livestock owners as they use the dam.

The Jang incident of the fisherman who emptied the dam as demonstrated in the quote above, made the *Tendamba* to put a curse on the offender. Concerning the importance of the spiritual role of

the *Tendamba* in every village, the various dam users have a strong belief that a sanction in the form of a deadly curse if one repeats its sin definitely stops one from doing it again. Such a curse also sends a message to other potential offenders and may help in governing the dam more sustainably. Such a curse is a form of a graduated sanction. In Goli more severe sanctioning takes place by the landowner who guards his dry season farms from his chair under the palm tree.

“Sometimes you have to be strict, because this is money. [...] I have to take punitive measures to prevent the cows from coming here, otherwise they would continue to enter my farms”

The punitive measure he talked about was that he ‘locked up a troublesome young man’ for a week and made him pay compensation for the crops he had destroyed with his bullocks.

5.4.6 Availability of low cost adjudication

Traditional local and governmental regional low cost adjudication are present in all the villages. For every village, the chief and *Tendamba* possess the authority to sanction people for deeds strongly considered as crimes such as stealing, adultery (for women) and rape. In every village, it is the chiefs and landowners together that can decide to punish someone. In most villages local police stations are not (yet) present or in the process of being built. As official policemen are not present in most villages, the elected unit committee members are seen as ‘voluntary policemen’. However, both the dry season farmers, livestock owners and Fulani pastoralists complained about the strong biases and weak enforcement of both formal national law and local bylaws. The chief in Takpo is having difficulty enforcing bylaws through the unit committee as these are easily bribed. As an example he stated the following case considering robbery by the sons of hosted Fulani:

“We saw that some Fulani were involved in armed robbery, the boys of the families we host. The young men don’t herd, and want to live a kind of life where they need money for. When we were about to arrest them, they ran away. They were traced to one of the settlements here, and the unit committee people charged them, it was proven that they’d done it. But the unit committee people did not take them to the police station and follow normal legal procedure, but instead made them pay to themselves, about five cows. They kept the cows and did not tell any of the elders. They sold the cows and shared the money among themselves. I told them that it was bad, but I did not take them to the police because as they do voluntary work, it would be difficult to get them replaced. They would see it as if me, the chief, would not support them – even though they’re wrong. So I just warned them and left the matter.”

Also the Fulani pastoralists complained about the insecurity of their stay because the livestock and land owners may expel them anytime based on accusations – whether true or false. The livestock owners protect them to threats from the villages to a certain extent and their relationships are mostly cordial. However if a group of villagers accuse the Fulani of for example destroying crops or theft of poultry they may be expelled by the *Tendamba*. According to some of the Fulani, their livestock owner mostly chooses ‘the side of the community’, as the Fulani can easily be replaced for another family when they are blamed for anything by the villages they are hosted by.

The dry season farmers on the other hand, complain about the corruptible state-led adjudication in the form of regional police based in Nadowli, who are easily bribed by wealthy cattle-owning Fulani settlers. As a Jang farmer stated:

“The police is always on the side of the rich, where they can get something to chop [eat]. They don’t support the poor [...] When you punish a Fulani boy that grazed on your farm by beating him, they go back and say they got beaten because you tried to steal their animals. The laws then don’t spare you – you might be charged or imprisoned [...] As a farmer like me, around June, July, it may be hard for me to find food to chop. But the Fulani sell one cattle for 3000 GhC and can settle any problem at all with the police. [...] The Fulani cooperate with the police, the Fulani chief is always in the police station, giving them bribes and reporting cases. If you report anything, you imprison yourself.”

In general, and as a response of the corruptible police, the villagers prefer the chiefs to resolve conflict. According to a Jang unit committee member, the court is strongly biased towards those who have political connections with the local government. Altogether, for the different dam users forms of adjudication are present, through local courts with the chief and *Tendamba* or at the regional police station. However, the courts seem not to be neutral and easily corruptible, either or both through political connections or bribes. A neutral review of argumentation and evidence is needed for any functional adjudication process (Fuller & Winston 1978). A neutral review of argumentation is not functioning in the Nadowli/Kaleo region, judging by the stories above from the different dam users.

5.5 Relationship between Resource System and Institutional Arrangements

5.5.1 Accountability of monitors and other officials to users

The ones mostly seen as responsible by the dry season farmers for monitoring the dams are the unit committees (see section 5.2.4). Accountability of these unit committee monitors highly varies in the studied area. In most villages, accountability appeared to be low as most committee members did not do basic tasks such as paying regularly visits to the dam nor had clear ideas on how many people actually use the dam. Only in Kanyin-guasi and Goli some accountability of monitors was there as these dams were more intensively monitored concerning water levels, and how many people from what places use the dam. It is likely that better monitoring takes place because these are the only dams where the monitoring is done by the most prominent dam users themselves: in Kanyin-guasi the unit committee member is a livestock owner, and in Goli the monitoring is not done by the unit committee but by the relatively wealthy landowner and dry season farmer in his ‘guarding post’ mentioned before. This man confirms the lack of monitoring done by unit/dam committees in Goli, as he stated;

“In principle we have the ‘dam rehabilitation committee’, a ‘water use association’, ‘fishermen association’ and an ‘irrigation committee’, but not in practice. These were put in place and elected with the construction of the dam. Every section was assigned to a man and a woman to be representing their section in the committees. The committee people are supposed to be monitoring the dam, but they don’t operate.”

From the Goli case it is clear that the assigned committees supposed to monitor the dam and the surrounding land do not operate, and the local landowner took up the task of monitoring himself. In the other villages (apart from Kanyin-guasi where a livestock owner took up the task of monitoring) the landowners did not do that, which results in situations where no accountable monitoring takes places at all. These are signs that appointing monitors with interventions may be highly inefficient and that local elites in the communities may take the task upon themselves if they actually use the dam. This makes sense, as they also possess the power to sanction offenders, which happens in Kanyin-guasi and Goli.

5.5.2 Restriction on harvest to match regeneration of the resource

Water use and inflow rates are not clearly matched for any of the dams. None of the dams have knowledge on the carrying capacity of the dams in the form of a rough number of the maximum amount of dry season farmers, cattle numbers that can use the dam without overusing the water. The unit committees have rough ideas on what water levels should be at the onset of the dry season in order for them to take it through the season, however these predictions are long term and therefore rather insecure. As there are no ideas on how many farming plots/cattle can use the dam, harvests are not restricted to the regeneration rate of water levels during the rainy season. This however does not mean that the water is automatically overused in the studied dams. On the contrary, most water levels remain rather high – with the exception of Jang and Nanville – and is usually sufficient for the dry season farmers and pastoralists using it. Most of the water available in the dams even appears underutilized, where more could potentially be used. The main reasons for this underutilization are the hard work it requires from dry season farmers to water their plots with buckets and the limited amount of pasture near the dams available for the pastoralists. According to them, both the cow numbers owned by themselves as the cattle they rear for the Ghanaian livestock owners have been increasing for those settled 4 years or longer, increasing pressure on the available pasture. Not only increasing cattle numbers, but also the area used for rainy season farming has been expanding – effectively reducing the area available with pasture. Both the growth in cattle numbers and land area under farming require the Fulani to drive the cattle further away from the villages and makes preventing crop damage more difficult when leaving and entering the village territories used for farming.

5.5.3 Low cost exclusion technology

The best available form of exclusion technology from using dams and surrounding land for farming or grazing are trees and fences. While none of the dams are fenced, most of the dry season farmers fenced their plots in order to prevent livestock from grazing on it. Most of the fences are made of wood by the farmers themselves while others have iron fences provided by NGOs or the local government and one woman uses plants as a fence (see table 5.5 below).

Method of farming plot protection	No. of dry season farmers	Fence made/provided by	Gender division of respondents
No Fence	21 (12%)	-	11 women, 10 men
Wood	91 (52%)	83 farmer themselves, 8 family members	35 women, 56 men
Plants	1 (1%)	1 farmer husband	1 woman
Iron	62 (35%)	59 NGO, 3 farmers themselves	37 women, 25 men
Total	175 (100%)	86 farmers themselves, 9 family members, 59 NGO	84 women, 91 men

Table 5.5: Fencing methods of dry season farmers

The wooden fences are the cheapest and most accessible form of exclusion technology, but these function often not very well. They are easily destroyed by hungry livestock, prone to catch fire, and may degrade rather fast. In Takpo for example, many dry season farmers recently gave up because their fences and harvest was totally destroyed by cattle during night-time. In Jang, many wooden fences were destroyed by a fire where after many farmers gave up dry season farming. Iron fences, which are generally more efficient in keeping cattle out are very costly for the farmers and they generally can not afford it (only 2 out of 175 surveyed farmers purchased their own iron fence).

Interestingly, women tend to have an iron fence from an NGO more often than the men, because these are recipient to NGO projects targeted at widowed women in Goli and Nanville. None of the 175 surveyed farms are guarded in the night. The interviewed farmers do not feel comfortable guarding it themselves and said it is too costly to outsource that. Efficient low cost exclusion technology considering the farms is therefore only available for those farmers who have been supported with iron fences from external interventions – which is roughly one in three farmers. Concerning low cost exclusion technology for the dams itself, these are not fenced so livestock can access it easily and to cut costs on interventions. Technology therefore currently only plays a role in excluding pastoralists from using farmland, and not in excluding from using the dam. However, some of the Fulani pastoralists said that access to dams becomes more difficult for them as the fenced area around the dam expands with the development of dry season farming.

5.5.4 Local authority is not undermined by central government

The enabling condition of local authority is largely met in the Nadowli/Kaleo district concerning dam management. While in theory land and water belong to the state, in reality these are managed by the traditional chieftainships – in line with the decentralization policies initiated during the 1990s (Clanet & Ogilvie 2009, see contextual chapter). This is also the case for the studied villages, where all interviewed chiefs and landowners confirm that they have the authority to locally manage the land and water resources, including dams, according to their will. Such local management also involves decisions on including and excluding certain pastoralists that attempt to use the dams and surrounding pasture, which is discussed in section 6.2 on inclusivity.

5.6 External Environment

5.6.1 Presence of supportive external sanctioning institutions

External sanctioning institutions are strongly related to the previously made point on availability of low cost adjudication (section 5.4.6). The regional police office and court are the external sanctioning institutions, but according to all the different dam users these are easily corruptible through bribes and political connections. The main issues wherefore supportive external sanctioning institutions are needed are issues of crime and conflict between Ghanaian farmers and Fulani pastoralists. According to some of the farmers in Jang and Takpo, the Fulani bribe the internal sanctioning institutions such as the chief and landowners as well as the external regional police with cows and money in order to get away with issues of crop destruction, (cattle) theft and in Takpo even cases of robbery and rape. Jang farmers also stated that Fulani animals from the neighbouring Wa East region enter their village territory to use their land and water. They bring large cattle numbers, and strongly suspect the chief in one of the main Wa East towns (Kata) collects bribes from these cattle-owning Fulani so they can settle there. They damage many farms in Jang, and do not have options to sanction the Fulani for this as both the Kata chief and the regional police is ‘on their side’ because of the cows they are given by the Fulani. From these examples, it is clear that for all dam users no supportive external sanctioning institutions are present.

5.6.2 Appropriate levels of external aid to compensate local users for conservation activities

This condition can be contextually translated as aid given by the local government and NGOs to dam maintenance conserving the water levels and perhaps fish and crocodile populations in the dams. Only in Takpo the NGO that funded the dam construction (GTZ) also provided help in rehabilitation and reconstruction of the dams several years later. In the other villages, dam rehabilitation has been organized by the dam users themselves from the late 2000s up to now: Takpo dam constructed in 1996 and rehabilitated in 2010, Nanville respectively in 1999 and 2016, Jang in 1991 and 2015, Goli in 1999 and repaired in 2010, and Kanyin-guasi in 1997 and 2011. No support to any of the villages has been given to conserve fish and crocodile populations. Therefore, external aid has in general been very low after dam construction, which is why it is plausible to assume that levels of external aid have not been ‘appropriate’.

5.6.3 Nested levels of appropriation, provision, enforcement and governance

Based on the analysis done in this chapter, by now can be assumed that there is a limited strength in the institutional arrangements concerning the studied APDs. There are only a limited number of rules which are generally difficult to enforce, and dam management activities appear to be minimal apart from very occasional communal labour. There are also no signs that the limited number of local institutional arrangements are nested in higher levels of governance. Regional government officials indicated that the dams are ‘left to be managed by the community’ and stated that they lack the resources to undertake maintenance themselves. The lack of resources may even be the reason why the APD management is devolved to the community level, as that takes away the responsibility of the governmental regional level to assist in (costly) dam maintenance and leaves it up to the communities. The interests of the community-scale authorities (chiefs, *Tendamba*) including pastoral dam use are supposedly nested into inter-communal institutional bodies, which is the regional paramount chief. However, the role of not only the regional government, but also the paramount chief concerning resource management of communities appears to be limited: In 2015, the paramount chief in collaboration with the regional government have made many calls to send out settled Fulani. None of the studied communities have listened to these calls. This both points towards a strong devolution in power and the limited influence of inter-community governance levels on dam and other resource arrangements.

Considering nesting of arrangements of dry season farmers on the micro into the community scale, only in Goli representatives of different irrigation sections are organized in an irrigation committee. Despite the non-functional state of the furrow irrigation system, Goli shows some nested level of irrigation water appropriation into the larger irrigation area. Such micro-local nesting is not present at the other dams, as irrigation systems are less extensive and private dugouts are dug as shared irrigation systems are not functioning. As such, no irrigation sections are represented in any overarching committee. Even in Goli, the committee is said to exist but activities are minimal.

Pastoral dam usage is also not nested in any level above that of the landlords and chiefs they are hosted by. While they often use pasture and water in neighbouring communities (see map 5.1 in section 5.3.1), no arrangements tend to be made on an inter-communal scale. The only form of inter-communal arrangement attempts are made by Kanyin-guasi, of which the livestock owners demand payments for dam use from neighbouring Kpaddinga and Nator livestock owners and the Fulani they hire.

5.7 Actual Levels of Collective Action

Now that all the enabling conditions for collective action have been analysed, it is in place to briefly look at what levels of collective action are actually met in the villages concerning dam maintenance. This is defined as to what extent the dam users actually maintain the dam, and whether their work is sufficient according to them. Collective action is generally not undertaken by livestock owners and Fulani pastoralists, which is why this analysis focuses on the dry season farmers.

Despite that most dry season farmers see the unit committees and landowners as responsible for dam maintenance (see section 5.2.4), many of them contributed to maintenance. Dam maintenance in the villages took place as an activity called ‘communal labour’, where the villagers voluntarily gathered in several instances to physically de-silt the dam and reconstruct the dam’s wall using mud and rocks. A large proportion of farmers contributed to dam maintenance in Kanyin-guasi, Nanville and Takpo, and not up to half the dry season farmers have done such maintenance in the other villages, but there were still considerable groups that contributed to maintenance (table 5.6). Notwithstanding such apparent high involvement in dam maintenance, around half of dry season farmers do not think the communal labour for dam maintenance has been sufficient to keep the water supply fully functioning. Jang is the only (rather odd) exception, where hardly any farmer contributed to communal labour while they are very satisfied with the labour that has been done by others. The question may have been interpreted wrongly, as the Jang dam is clearly degraded and the irrigation system has dried up and the dam provided not sufficient water at the end of the dry season.

<i>Village</i>	No. of dry season farmers that contributed to dam maintenance	No. of dry season farmers that think the communal labour helped on the long term
Zambogo	8 out of 21 (38%)	9 out of 21 (43%)
Takpo	16 out of 29 (55%)	10 out of 26 (38%)
Kanyin-guasi	21 out of 25 (84%)	7 out of 20 (35%)
Nanville	24 out of 28 (85%)	9 out of 26 (35%)
Jang	3 out of 25 (12%)	22 out of 25 (88%)
Goli	13 out of 28 (46%)	8 out of 15 (53%)

Table 5.6: Contribution to dam maintenance done and satisfaction thereof by dry season farmers

5.8 Summary of Results on Sustainability

The results discussed in this chapter are summarised for each studied dam village in the table below, and on the bottom of the table is displayed how many of the enabling conditions of collective action each community adheres.

Enabling condition for sustainable CPR governance	Jang	Zam-bogo	Kanyin-quasi	Tak-po	Nan-ville	Goli
<i>1. Resource characteristics</i>						
(i) Small size	Yes	Yes	Yes	Yes	Yes	Yes
(ii) Well-defined boundaries	Yes	Yes	Yes	Yes	Yes	Yes
<i>2. Group characteristics</i>						
(i) Small size	Yes	Yes	Yes	Yes	Yes	Yes
(ii) Clearly defined boundaries	No	No	Yes	No	No	Yes
(iii) Shared norms	Yes	No	No	No	Yes	No
(iv) Past successful experiences – social capital	Yes	Yes	Yes	No	Yes	Yes
(v) Appropriate leadership (young, familiar with changing external environment, connected to local traditional elite)	No	No	No	No	No	Yes
(vi) Interdependence among group members	Yes	Yes	Yes	No	Yes	No
(vii) Heterogeneity of endowments	Yes	Yes	Yes	Yes	Yes	Yes
(viii) Homogeneity of identities and interests	No	No	No	No	No	No
<i>3. Relationship between resource system characteristics and group characteristics</i>						
(i) Overlap between user group residential location and resource location	No	No	No	No	No	No
(ii) High levels of dependence by group members on resource system	Yes	No	Yes	Yes	No	Yes
(iii) Fairness in allocation of benefits from common resources	No	No	No	No	No	No
<i>4. Institutional arrangements</i>						
(i) Rules are simple and easy to understand	Yes	Yes	Yes	Yes	Yes	Yes
(ii) Locally devised access and management rules	No	No	Yes	No	No	Yes
(iii) Ease in enforcement of rules	No	No	No	No	No	No
(iv) Graduated sanctions	No	No	No	No	No	Yes
(v) Availability of low cost adjudication	Yes	Yes	Yes	Yes	Yes	Yes
(vi) Accountability of monitors and other officials to users	No	No	Yes	No	No	Yes
<i>5. Relationship between resource system and institutional arrangements</i>						
(i) Match restrictions on harvests to regeneration of resources	No	No	No	No	No	No
<i>6. External environment</i>						
(i) Low cost exclusion technology	No	No	No	No	No	No
(ii) Central governments should not undermine local authority	Yes	Yes	Yes	Yes	Yes	Yes
(iii) Supportive external sanctioning institutions	No	No	No	No	No	No
(iv) Appropriate levels of external aid to compensate local users for conservation activities	No	No	No	No	No	No
(v) Nested levels of appropriation, provision, enforcement and governance	No	No	No	No	No	No
No. of enabling conditions met	10	9	12	7	10	13

Table 5.7: Enabling conditions for collective action met per studied dam community

Resource and group characteristics are largely met, while shared norms, appropriate leadership and homogeneous identities and interests tend to lack. Most necessary institutional arrangements are lacking such as locally devised rules, enforcement of those rules, sanctions, and accountable monitors. There are also no harvest restrictions, and the external environment is generally not supportive for collective action. While local authority is not undermined, supportive external sanctioning, aid and technology are lacking. Altogether, Goli has most enabling conditions, 13 out of 25, and all the others between 7 and 13.

5.9 Manipulability of the Enabling Conditions

In order to determine how and to what extent the dams can be manipulated with further interventions, the final section of this chapter presents which enabling conditions can be manipulated for the studied context. 20 out of 25 conditions can be somehow manipulated, however some much more directly than others (see table 5.8). For example, determining the size of the dam upon construction is much more straightforward and direct than advising how to enforce local rules and lobbying at local governments not to undermine local authority.

Enabling condition for sustainable CPR governance	Manipulatable with dam intervention
<i>1. Resource characteristics</i>	
(i) Small size	Yes, construction size of dam
(ii) Well-defined boundaries	Yes, construction of dam
<i>2. Group characteristics</i>	
(i) Small size	Yes, size of dam and allocation to beneficiaries
(ii) Clearly defined boundaries	Yes, informing who can use it, open access or not
(iii) Shared norms	No
(iv) Past successful experiences – social capital	No
(v) Appropriate leadership (young, familiar with changing external environment, connected to local traditional elite)	Yes, organize leadership appointment
(vi) Interdependence among group members	No
(vii) Heterogeneity of endowments	No
(viii) Homogeneity of identities and interests	No
<i>3. Relationship between resource system characteristics and group characteristics</i>	
(i) Overlap between user group residential location and resource location	Yes, aim to build dams near farmer's residential location
(ii) High levels of dependence by group members on resource system	No, but only build dams if needed to maintain livelihoods and not just as side-activity
(iii) Fairness in allocation of benefits from common resources	Yes, again focus on that both rich and poor can use the dam
<i>4. Institutional arrangements</i>	
(i) Rules are simple and easy to understand	Yes, advice on rules to use
(ii) Locally devised access and management rules	Yes, advice on rules to use
(iii) Ease in enforcement of rules	Yes, advice on how to enforce rules
(iv) Graduated sanctions	Yes, advice on possible sanctions
(v) Availability of low cost adjudication	Yes, offer conflict resolution support
(vi) Accountability of monitors and other officials to users	Yes, advice on who monitors (preferably users themselves)
<i>5. Relationship between resource system and institutional arrangements</i>	
(i) Match restrictions on harvests to regeneration of resources	Yes (providing science based information on regeneration patterns and the expected result of restriction rules)
<i>6. External environment</i>	
(i) Low cost exclusion technology	Yes (indirectly), provide loans for fences or fences directly (depending to what extent pastoralists are aimed to be excluded)
(ii) Central governments should not undermine local authority	Yes (indirectly), advocacy and lobbying as part of interventions (Barnes & Van Laerhoven 2014)
(iii) Supportive external sanctioning institutions	Yes (indirectly) advice on how to match local sanctioning rules with existing external provisions (Barnes & Van Laerhoven 2014)
(iv) Appropriate levels of external aid to compensate local users for conservation activities	Yes, but for dams only relevant for preservation of fish/crocodile species
(v) Nested levels of appropriation, provision, enforcement and governance	Yes (indirectly), inform on representation of irrigation sections and pastoralists from different areas into local and regional governance bodies

Table 5.8: Manipulability of enabling conditions for collective action for the studied APDs

Combining the data from table 5.7 and 5.8 above, the number of manipulatable and non-manipulatable enabling conditions are generally met in the studied communities is determined for every village (see table 5.9). Most of the enabling conditions that are met are manipulatable, and the non-manipulatable that are met are generally a heterogeneity of endowments, social capital and interdependence among group members. The manipulatable enabling conditions that are not met fall under relationships between resource system characteristics and group characteristics, institutional arrangements and the external environment. These include the overlap over users residential location with resource location, fairness in allocation of dam benefits, lacking locally devised access/management rules, no ease in enforcement of rules, lack of graduated sanctions, and the match of restrictions on harvest to regeneration of the dams. Lacking manipulatable enabling conditions concerning external environment are a low cost exclusion technology, supportive external sanctioning institutions, appropriate levels of external aid for conservation activities, and nested levels of appropriation, provision enforcement and governance of the dams (see table 5.7). So according to this analysis, the main problem for the studied dams concerning sustainability lies in a lack of necessary institutional arrangements, unproductive relationships between resource system characteristics and group characteristics, and an unsupportive external environment. Less of a problem are the enabling conditions concerning group and resource characteristics. This suggests that interventions should focus on developing institutional arrangements and a supportive external environment while not strongly manipulating the APD resource and group characteristics (such as dam size and user group size). These results are discussed in chapter 8.

<i>Village</i>	<i>No. of enabling conditions met</i>	<i>Manipulatable enabling conditions not met</i>
Zambogo	9 (of which 7 manipulatable)	13
Takpo	7 (of which 6 manipulatable)	14
Kanyin-quasi	12 (of which 10 manipulatable)	10
Nanville	10 (of which 7 manipulatable)	13
Jang	10 (of which 7 manipulatable)	13
Goli	13 (of which 12 manipulatable)	8

Table 5.9: Number of manipulatable enabling conditions met and not met per studied dam village

6. Results II: Inclusivity of the APDs

When analysing inclusivity of the APDs, it is important to recognize that in principle the village dams are open access and free to use for all the people living in that village. In practice however, only a selection of people from each village uses the dams – those that do dry season farming and/or keep livestock – as well as some Fulani pastoralists settled elsewhere in the studied region. The next empirical chapter explores what people in reality use and benefit from the dams and to what extent people are excluded in any way from using any of the studied APDs. The reasons for exclusion explored can be of socio-economic nature such as a lack of economic assets, socio-cultural nature such as belonging to the Fulani ethnic group or spatial-temporal such as living in a village without a dam.

6.1 Dry Season Farming: A Necessity for the Poor, or a Hobby for the Rich?

Socio-economic inclusivity basically concerns the socio-economic diversity of the dry season farmers and livestock owners. Are it mainly a small group of relatively rich that invest in dry season farming and grow cash crops and/or have cattle as an extra income, or is it done by the poor to secure their food supply? As a recap, the variables below were researched to determine socio-economic inclusivity (table 6.1)

Type of inclusivity	Operationalised variables
Dry season farming inclusivity	<ul style="list-style-type: none"> - Number of people compared to community populations using the APD - Number of farmers that sell their crops at the market - Number of farmer that use chemical fertilizer compared to the division of 'poor', 'middle' and 'rich' people in the respective community (according to ALP (2015) data) - Number of farmers that buy seeds themselves

Table 6.1: Operationalised variables for socio-economic inclusivity

6.1.1 Dry season farmers: numbers and crop usage

The first observation is that only small groups of people in the communities do the dry season farming. Ranging from 21 to 60 households, the dry season farmers are estimated to range from only 8% up to 31% of every studied community (see table 6.1). While the number of household per community highly differ, from 625 in Takpo to around 80 in Kanyin-guasi, the number of dry season farmers per community are less diverse (from 21 to 60 households, visualised in figure 6.1). Therefore, the variety in dry season farming households numbers is low compared to variety in total household numbers of the communities. This means that the share of dry season farming households on the total village populations is larger in the smaller communities: around 10% of the households do dry season farming in larger communities and 25% in smaller communities.

Village	No. of households doing dry season farming
Zambogo	est. 21 out of 118 (18%) (ALP 2015)
Takpo	est. 50 out of 625 (8%) (ALP 2015)
Kanyin-guasi	est. 25 out of 80 (31%)
Nanville	est. 28 out of 220 (13%) (ALP 2015)
Jang	est. 60 out of 600 (10%)
Goli	est. 30 out of 400 (8%)

Table 6.2: Amount and proportion of community households doing dry season farming (based on estimated from village visits and ALP (2015) data)

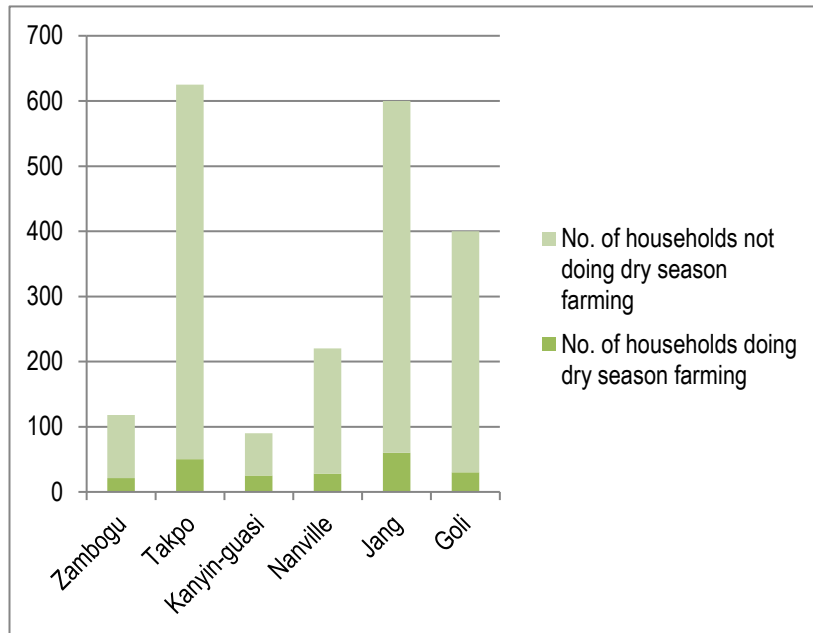


Figure 6.1: Absolute number of household heads and dry season farming household per community (based on data in table 6.2 above)

While there is no quantitative data on the number of livestock owners using the APDs, it appears from the village visits that their numbers range from 5 to 20 per community. This is in line with the ALP data discussed below (table 6.3), as the people belong to the ‘rich’ group if they own 10 or more cattle. Livestock owners are therefore even a smaller – and richer – minority using the dam than dry season farmers.

The second observation concerns whether the dry season farmers sell their crops at local markets. The results are clear: all of the surveyed farmers sell their crops at the market in their or in a neighbouring community. Therefore, none of the surveyed dry season farmers solely use the crops directly for their own food needs. The widowed women however (more than one third of the surveyed dry season farming women) indicated in a focus group discussion they directly rely on selling the dry season crops to buy other food stocks, such as rainy season crops.

6.1.2 Socio-economic diversity of the dry season farmers

The third result compares the share of dry season farmers that use chemical fertiliser to the distribution of wealth in the respective community. CARE’s Adaptation Learning Programme (ALP) has made a useful assessment of household numbers and economic wealth of three of the studied villages – Zambogu, Takpo and Nanville – which are used in this analysis. Very poor are defined by ALP as not being able to afford basic needs and rely on others for food. Poor means having only one meal a day, inadequate housing, small food stocks and education up to junior high school. Middle means having sufficient food, use chemical fertiliser for farming, electricity, brick housing, owning some animals, a radio, and often a motorbike. Rich means having adequate food surplus all year, own cattle usually up to 10 and at least a five-acre farm for which they use chemical fertiliser and hire a tractor to plough. The assumption here is that a farmer can be considered poor if he/she does not use chemical fertiliser for (dry season) farming. According to ALP, chemical fertiliser generally cannot be afforded by the (very) poor dry season farmers, but can by their ‘middle’ and rich colleagues (ALP 2015). Comparing the share of ‘very poor’ and ‘poor’ to the share of ‘middle’ and ‘rich’ in these villages to the estimated number of dry season farmers that use chemical fertiliser provides an insight on socio-economic inclusivity of their dams. The distribution of wealth per village for the 3 villages ALP (2015) provided data on is displayed below (table 6.3). The other three villages for which there is no ALP data on

(Kanyin-guasi, Jang and Goli) division of wealth has been roughly estimated. The average results of the three villages for which there is ALP data has been extrapolated for these villages.

Village	No. of households	No. of 'very poor'	No. of 'poor'	No. of 'middle'	No. of 'rich'
Zambogo	118	20 (17%)	41 (34%)	29 (25%)	28 (24%)
Takpo	625	500 (80%)		120 (19%)	5 (1%)
Nanville	220	38 (17%)	50 (23%)	110 (50%)	22 (10%)
Kanyin-guasi	Est. 80	Est. 20%	Est. 38%	Est. 30%	Est. 12%
Jang	Est. 600	Est. 20%	Est. 38%	Est. 30%	Est. 12%
Goli	Est. 400	Est. 20%	Est. 38%	Est. 30%	Est. 12%

Table 6.3: Number and share of very poor, poor, middle and rich households in three of the studied villages (based on ALP 2015 data)

The number of farmers that use chemical fertiliser is the indicator to be compared to the wealth distribution of the communities above. As those farmers that use chemical fertiliser are assumed not to be (very) poor, the socio-economic diversity of the dry season farmers is then determined to be low, moderate or high. In Zambogo, socio-economic diversity of the farmers is high because the share of dry season farmers using chemical fertiliser is similar to the share of middle and rich people in the total community: 43% use chemical fertiliser while 49% are middle and rich. The wealth of dry season farmers therefore roughly reflects the distribution of wealth in the community. While only around 18% do dry season farming, both poor and non-poor are included – indicating a high socio-economic inclusivity. In Takpo, while a large number of households are poor (500 or 80%), more than half of the relatively small group of dry season farmers use chemical fertilizer. This means that dry season farmers are relatively wealthy compared to overall community wealth, lowering the dam's socio-economic inclusivity. In the last village of which the number of poor households is known, Nanville, the share of (very) poor people is a bit smaller (40% of households). The dry season farmers appear to be primarily the poor however, as only two use chemical fertilizer. Poorer people therefore seem more included in dry season farming rather than middle or rich people. While this seems supportive for the poor, it points to a low socio-economic diversity of the farmers. Not including the wealthier of a village by all means also lowers socio-economic inclusivity, however perhaps with less dire consequence for adaptive capacity or maintaining livelihoods of those excluded. The discussed results and the estimates for the villages lacking data on are displayed below (table 6.4)

Village	No. of dry season farmers using chemical fertilizer	Socio-economic diversity of farmers
Zambogo	9 out of 21 (43%)	High
Takpo	16 out of 29 (55%)	Low (mainly rich)
Kanyin-guasi	8 out of 25 (32%)	High
Nanville	2 out of 28 (7%)	Moderate (mainly poor)
Jang	19 out of 25 (76%)	Moderate (mainly rich)
Goli	20 out of 28 (71%)	High

Table 6.4: Number and share of dry season farmers using chemical fertiliser and socio-economic diversity of the dry season farmers

Despite that the results for Kanyin-guasi, Jang and Goli are estimates due to lacking data, these estimates are in line with the results in the 'heterogeneity of endowments' section in the previous chapter (5.2.6). The farmers had been asked whether some farmers are richer and make investments in the common water supply. Large majorities confirmed this for Goli, Jang and Kanyin-guasi. In Kanyin-guasi this goes combined with only a third of farmers using chemical fertilizer, also indicating high-socio-economic diversity of farmers. In Goli, a large group of farmers use chemical fertilizer

while also a large group of widowed women is involved in farming together with a wealthy landlord, also indicating high diversity. In Jang, dry season farmers seem to be relatively wealthy as a large group of them uses chemical fertilizer, which in reality also appeared to be the case as a large group of them also belonged to wealthy families also owning cattle.

The last observation to determine socio-economic inclusivity of the APDs concerns the share of dry season farmers that buy their own seeds or that seeds are provided by an NGO. It appears that nearly all the surveyed farmers buy their own seeds, even in Nanville where dry season farmers are assumed to be poor. Only in Goli a group of widowed women are given seeds by an NGO. So as all other dry season farmers buy their own seeds at the local market, a few in town and a few get them from the local government, this provides no clear further insight on socio-economic inclusivity of the dams.

6.2 Fulani Pastoralists: Exploited Tenants or Bribing Free Riders?

Socio-cultural inclusivity regards to what extent the Fulani pastoralists are able to use the studied APDs for their own cattle. Are the Fulani pastoralists hired for their cheap labour while they hardly personally benefit from the APDs, or are they able to expand their cattle herds with the help of the APDs? And what think the dry season farmers also using the dams of the Fulani presence? As a quick recap, the considered variables are listed below (table 6.5)

Type of inclusivity	Operationalised variables
Fulani inclusivity	<ul style="list-style-type: none"> - Number of Fulani that are settled in each studied community - Whether the settled Fulani is allowed to own cattle - Whether outside Fulani (settled in neighbouring communities/districts or migrant Fulani) are allowed to use the APD - Number of dry season farmers happy/unhappy with the Fulani using the APD and why - Number of dry season farmers that want the Fulani to leave and why

Table 6.5: Variables used to determine Fulani inclusivity

6.2.1 Settled Fulani households and cattle ownership

Most of the Fulani households in each community have been interviewed, and were asked whether they were allowed to own 10 or more cattle. As Fulani settled in communities neighbouring the studied communities also use the APDs, the Fulani settled in Kpadinga and Nator have also been interviewed and are added to the analysis. It appears that most of the Fulani families are allowed to own 10 or more cattle (see table 6.6). Since 2 years ago, only in Goli and Nator the Fulani were no longer allowed to own cattle. In Goli, cattle-owning Fulani have been expelled and replaced with non-cattle owning Fulani around 2014 due to crop destruction and pasture and tree degradation according to the dry season farmers.

Village	No. of Fulani that are allowed to own 10 or more cattle
Zambogo	0 out of 0
Takpo	4 out of 4
Kanyin-guasi	1 out of 1
Kpadinga	3 out of 4
Nanville	3 out of 3
Jang	6 out of 6
Goli	0 out of 2
Nator	0 out of 2
Naro	1 out of 1

Table 6.6: Number of Fulani families settled in each community allowed to own 10 or more cattle

Most of the Fulani households are allowed to own medium (up to 80 cows) cattle herds, which they do (18 out of 23 interviewed Fulani households owning between 5 up to 80 cows). This does not mean that these Fulani households are all wealthy however, as around half of the interviewed households own only a few cattle, and they have no money or desire to send their children to school, have insufficient food and inadequate housing. The other half can be considered middle-income or rich, as they have sufficient food, adequate housing, own more than 10 cattle and sometimes a motorbike. Children do not often go to school however, even for the latter group as they are needed to rear the cattle of their family and of the village they are hosted by. School is also not seen as very important by most of the interviewed Fulani households, where the main priority for the children lies in herding the cattle – and is therefore no realistic indicator for Fulani wealth.

6.2.2 Fulani resource use and cross-communal movement

While the Fulani can freely use the dams of the studied villages they are hosted by, Fulani exclusion of using land and APD water does emerge when Fulani pastoralists move around to gain access to pasture and APDs, or cross the borders of the village territory that hosts them in search for pasture and water. Generally, Fulani that rear their cattle and that of livestock owners are free to use the dams in neighbouring villages. Such freedom is not because the water is generally abundant, but also because it is socio-culturally unacceptable for many dam users to exclude one's access to water. The Nanville unit committee chair summarized this cultural view by saying that *"every living thing must take water...even if they [Fulani] would destroy farms and empty the dam, we would never exclude anyone because God would not be happy"*.

While this cultural values of cross-communal ownership of water may count in principle, in reality accessing dams in places outside of the village territory which hosts them can be challenging for the Fulani. When I was herding through the Zambogo territory with a Fulani based in Jang, some of the farmers we passed by gave suspicious looks and held their machetes and cutlasses ready in case they had to chase the Fulani boy and their cows out of their newly sown yam farms. On our way to the Zambogo dam, the Fulani boys told me that they often get chased and beaten by the farmers because they think they come too close to their farms with the cattle. It was however the only passage to the dam and keeping the cattle off the unfenced farms was challenging because of the large cattle numbers. Most of the dry season farmers state that their aggressive stance is needed because Fulani are careless for their farms, and only care for the cattle. The Fulani complain that the farmers are often physically aggressive and sometimes wound their cows while they do their utter best to keep the animals off the farms. As such a blame game takes place between the different resource users as described by Fielmua et al (2014): while the issues occur in reality, farmers may inflate their crop damage and Fulani may inflate farmer aggression. In reality, it was observed that cattle numbers are often too high to keep them completely under control when driving them through the narrow corridors in between the farms, where Fulani boys often have responsibility over up to 50 cattle each. The Fulani also stated that both the dry and rainy season farming areas are growing, making preventing crop damage more difficult and pasture more scarce. The areal growth in farming land was confirmed by all the other interviewed actors.

Most conflicts for dry season farmers in the studied villages lie with Fulani from outside their village territory that come in to use the dams during the dry season. During the rainy season, small water bodies and pasture are abundant and the pasture and dams are not needed by Fulani settled in villages lacking pasture and have no APD. The most usual Fulani pastoralist movement during the dry season and areas of conflict are mapped out (see figure 6.3).

During the dry season they move towards nearby dams up to around 12 kilometres, while some Fulani pastoralists enter the area from Wa East located around 15 kilometres from Jang. As the dam's water in Jang is often insufficient during the dry season, the Jang Fulani resort to the dam in Zambogo. According to the dry season farmers in Zambogo, this influx often leads to conflict with them because they destroy crops and overuse the water. This explains the aggressive stance of the farmers in Zambogo when I was herding cattle with the Jang Fulani towards the APD. A similar problem occurs in Takpo, where often conflict occurs because the Fulani settled in neighbouring Nator come in with large herds to find pasture and use the APD. Since two years ago, the Nator Fulani are no longer allowed to use the Goli APD because of the problems it previously caused there. So today, thanks to this Fulani exclusion, Goli now hardly experiences any further conflict with Fulani from outside their community. In Kanyin-guasi there is also hardly any conflict, while the Fulani from Naro and Kpaddinga still use the APD while refusing demanded payments (see section 5.4.3). During the

fieldwork in early 2017, the dam users in Kanyin-guasi requested funds for maintenance from the Kpadinga livestock owners several times. They did not respond however, and keep using the dam. the Kanyin-guasi villagers do not exclude them from using it because it is seen as unethical as they are ‘the same tribe’ and live in proximity of each other. Fortunately, conflict hardly occurs according to the Kanyin-guasi livestock owners because they arranged cattle corridors towards the dam where no dry or rainy season farming is allowed to take place.

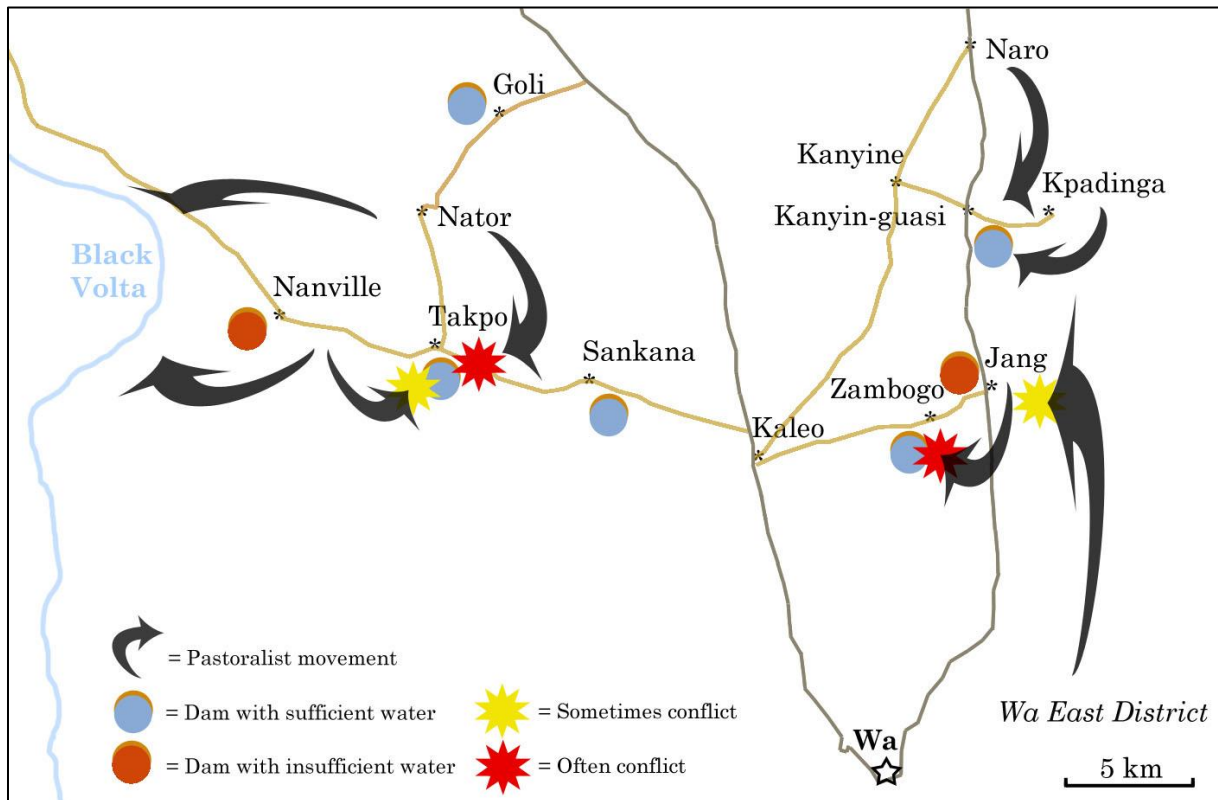


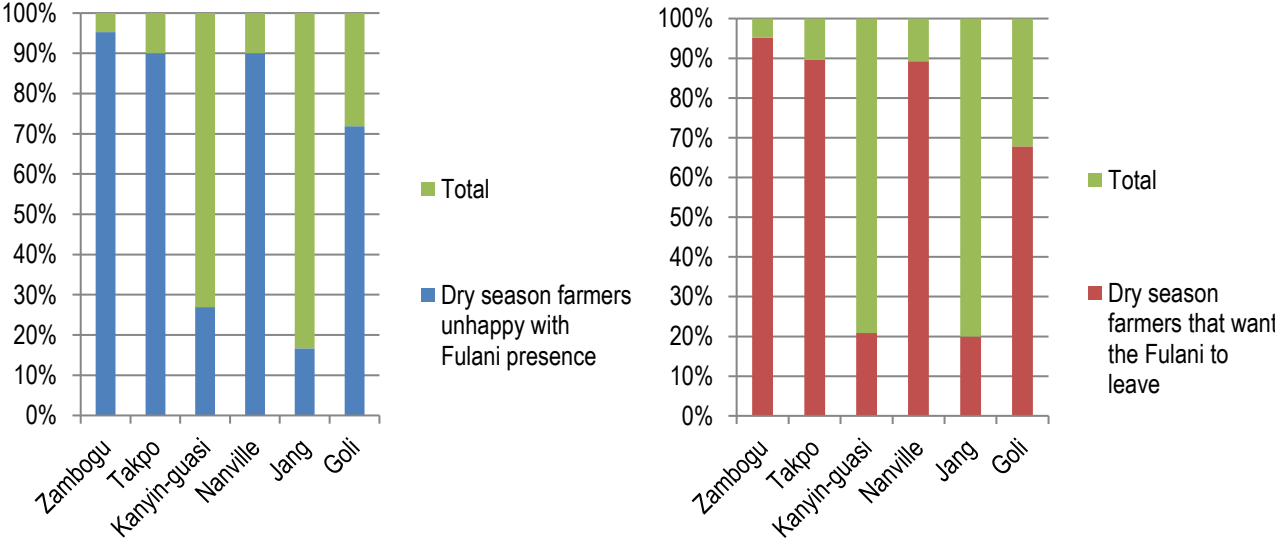
Figure 6.3: Map on cross-communal Fulani pastoralist movement and conflict-prone areas with farmers during the dry season (map by author, based on Google Maps)

6.2.3 Community perceptions of Fulani

Fulani are often seen as ‘strangers’ by the villagers because they are non-Ghanaian, and are also often blamed for criminal activities. Despite seen as strangers, they are not excluded from using the dams for the cattle either owned by them or the livestock owner hiring them. But as they are seen as hired outsiders, they are in no way included in dam management or maintenance. The interviewed Fulani generally understand and accept that role as the land on which they reside is not their ‘native’ land and have generally only settled down from 1 up to 10 years. The Fulani are also not involved in dry season farming activities. Dry season farmers say they do not involve them because ‘it is not their culture, they are pastoralists, they only care about their cattle’. According to some of the Fulani they would not be reluctant to be involved, but that they do not have the desire to do dry season farming because of their insecurity of permanent stay: they may be sent out when they are no longer wanted by the village or when they want to find better pasture further south. Making place-bound long term investment needed for (dry season) farming is therefore too risky. Investing in cattle herds fits their insecure stay better, as in case they have to leave, they can at least bring their cattle with them. Some of the Fulani women do grow edible (‘green’ or ‘bean’) leaves, which could be done on the irrigable land around the APD but which they currently only do around their compounds in the dry season. Usually, the

Fulani are given land around the compounds and kraals to do rain-fed maize farming for subsistence, and the livestock owner hosting them often helps with ploughing and weeding, as well as provides them with seeds.

While the livestock owner relations with Fulani pastoralist are usually cordial and cooperative, the surveyed farmers have a negative perception of the Fulani settlers in their communities. Most of the dry season farmers in the studied villages are not happy with the presence of Fulani pastoralists and want them to leave their community, with the exception of Jang and Kanyin-guasi (see figures 6.4 and 6.5 below).



Figures 6.4 and 6.5: Share of dry season farmers that want the Fulani settled in their community to leave, and share that is unhappy with the Fulani settled in their community

Why are such large shares of dry season farmers unhappy with the Fulani in their community and want them to leave? And why is this less the case in Kanyin-guasi and Jang? The main reason for discontent with Fulani presence is crop destruction. Nearly all of the farmers experience crop destruction by cattle reared by Fulani, which is why they are unhappy with their presence (see table 6.7). Only some of them also dislike them because they think the Fulani are criminal in general – a clear sign of stigmatisation.

Village	No. of farmers unhappy with Fulani presence because crops got destroyed	No. of farmers unhappy with Fulani presence because they are 'criminals in general'
Zambogo	21 out of 21 (100%)	3 out of 21 (14%)
Takpo	26 out of 27 (96%)	3 out of 27 (11%)
Kanyin-guasi	7 out of 7 (100%)	1 out of 7 (14%)
Nanville	23 out of 27 (85%)	10 out of 27 (37%)
Jang	4 out of 4 (100%)	1 out of 4 (25%)
Goli	22 out of 23 (96%)	2 out of 23 (9%)

Table 6.7: Number of dry season farmers that are unhappy with Fulani presence because crops got destroyed or because they perceive Fulani as criminals in general

Village	No. of farmers who had a conflict with settled Fulani
Zambogo	9 out of 21 (43%)
Takpo	7 out of 29 (24%)
Kanyin-guasi	1 out of 25 (4%)
Nanville	2 out of 28 (7%)
Jang	3 out of 25 (12%)
Goli	9 out of 28 (32%)

Table 6.8: Number of dry season farmers that had a conflict with the settled Fulani in their community

The results of discontent on Fulani presence are roughly in line with the number of farmers that actually experienced a conflict with the settled Fulani. In some villages – Zambogo, Takpo and Goli – up to half of the dry season farmers has had a conflict with the Fulani, while this number is lower in the other villages Kanyin-guasi, Nanville and Jang. For Kanyin-guasi and Jang, the low number of conflicts is in line with general low discontent with the Fulani presence. Nanville is the only exception here, having high discontent with Fulani presence while having a low number of conflicts – for uncertain reasons. The Fulani there said they often use the nearby Black Volta during the dry season as the Nanville APD water levels become low – perhaps explaining the low number of conflict. For Goli there must be noted that most of the conflicts took place 2 years ago or longer, before the cattle-owning Fulani families were expelled from their territory.

Apart crop damage resulting in conflict, and general stigmatisation, it became clear from the focus group discussions that the negative stance of farmers is also motivated by accusations that Fulani use resources unsustainably. Farmers blame Fulani for grazing in the night leading to overgrazing, cutting economic trees for their cows to eat, and carelessness about damaging farm plots. They state that the Fulani do such free riding behaviour as they have no incentive to use resources sustainably because they can just leave somewhere else when the land or water sources are degraded. While livestock owners that contract the Fulani are responsible for their presence, the aggressive stance of the farmers is not directed towards these relatively powerful people. They know they usually do not have the power to demand from them to stop hiring the Fulani. Indeed, in most villages, the concentration of power to allow a Fulani household to stay lies with the local elites – chief, *Tendamba* and landowners. These local authorities can decide collectively whether a Fulani family is hosted, sacked or replaced. The *Tendamba* has most power in this decision, even more so than the chief. The Takpo chief for example, stated that he set up a bylaw to ban any cattle-owning Fulani from their territory because of the severe crop destruction that took place. The *Tendamba* and other livestock owners however refuse to take back their cattle as the Fulani offers them cheap labour and extra cattle. Up to today, crop destruction continues and the chief and farmers are powerless to enforce the expulsion of the cattle-owning Fulani. Excluding Fulani is therefore not a matter to decide for the common men and women or sometimes even the chief, but for land- and livestock owners. This can be a major underlying factor why Fulani-farmer conflicts are ongoing: as the livestock owners benefiting from the Fulani herding are usually the ones who can decide whether a Fulani can stay, while they are not the ones experiencing crop damages. They also do not suffer greatly from compensating for crop damages, as the compensation rule is hardly enforced in any of the villages (see section 5.4.4). From the Takpo case it is clear that the Fulani invest into ‘leadership alliances’ (as described by Yembilah & Grant (2014)) with the *Tendamba* and/or landowners, bypassing the chief if necessary as a strategy to secure their stay.

The farmers’ discontent with Fulani presence to which is not responded may explain the aggressive stance of many farmers towards the Fulani, and is also likely to lower trust or a feeling of togetherness (i.e. social capital), which is one of the necessary group characteristic for collective

action (see section 5.2.3). As the concentration of power to host or expulse Fulani is concentrated in the hands of the chief, *Tendamba* and landowners who are usually not dry season farmers, it may even be in their interest to host Fulani with large cattle herds.: wealthier Fulani are likely to be more generous in allocating them a number of animals while also taking care of them.

Two communities demonstrate less discontent at the farmer's side with the Fulani settled in their community territory: Jang and Kanyin-guasi. This is because their dry season farms hardly got destroyed by the cattle, only a few farmers in each village (see table 6.7). The number of conflicts are also low (table 6.8). Most of the people happy with Fulani presence in these villages state that they are needed to rear the cattle of the chief, landowners and minor livestock owners. In both villages, the Fulani families rear cattle of large number of minor livestock owners, of whom most village members are relatives. So even though some crop damage occurs, the villagers recognize the mutual benefits they derive from their relationship with the Fulani settled on the brinks of the village. In Jang, despite conflicts with Fulani from Wa East, the settled Fulani have been able to improve their relationship with the villagers. The largest Fulani family has been there for 15 years without major problems, according to the livestock owners and the Fulani household head himself because they kept their cattle herd only medium in size, preventing damage to crops. These are signs that Fulani-farmer relations may be better if cattle ownership is less concentrated with the local elites and more spread out across the community populations, and cattle herds are kept at medium sizes for which sufficient pasture is available hence crop damage is less likely.

While there is general discontent with the farmers on the Fulani presence, there are also some more positive perceptions. They are seen as having superior pastoral skills, and some of the villagers think that the Fulani also possess mystical powers and are thought to be able to predict the future. The heads of Fulani households sometimes earn extra income by giving soothsaying sessions to the Ghanaian villagers, while their sons drive the cattle and wives milk the cows. According to the Fulani themselves, many villagers are not happy with their presence because they feel threatened and are envious of their wealth in cattle. Therefore most of them prefer to 'live by themselves' and do not feel comfortable mingling with the villagers. Instead, the Fulani look for social contact with each other, and visit each other for weddings and funerals. In the rainy season, the Fulani women group up to sell the abundant milk in the more major towns of Nadowli, Kaleo and Wa and sometimes group up to process it into a cheese (*wagachi*). Due the high diversity in cattle wealth of Fulani settlers and their livelihood incomes apart from livestock, the common portrayal in development literature of Fulani pastoralist as a marginalized, vulnerable and poor group is highly inaccurate. The Fulani have a mixed role in the communities, and are perceived as both strangers and skilful pastoralists by the villagers.

6.3 Summary of Results on Inclusivity

The results discussed in this chapter are summarised below (table 6.9), determining overall inclusivity per studied APD village.

Village	Inclusivity of dry season farmers	Inclusivity of Fulani pastoralists			Overall inclusivity
	Socio-economic diversity of farmers	Host cattle-owning Fulani	No. of farmers that want the Fulani to leave	Stance towards Fulani from outside community	
Zambogo	High	No	-	Very negative	Low
Takpo	Low (mainly rich)	Yes	High	Negative	Low
Kanyin-guasi	High	Yes	Low	Negative	High
Nanville	Moderate (mainly poor)	Yes	High	Negative	Moderate
Jang	Moderate (mainly rich)	Yes	Low	Negative	High
Goli	High	No	Moderate	Very negative	Very low

Table 6.9: Inclusivity of the studied APDs

7. Results III: Synthesis - APD positions in the SIM model

The next step is to demonstrate the results on sustainability and inclusivity of every dam using the SIM model, and then to suggest how these parameters can be manipulated with adaptation interventions. The position of each dam with regard to sustainability and inclusivity are shown in the SIM model below (figure 7.1).

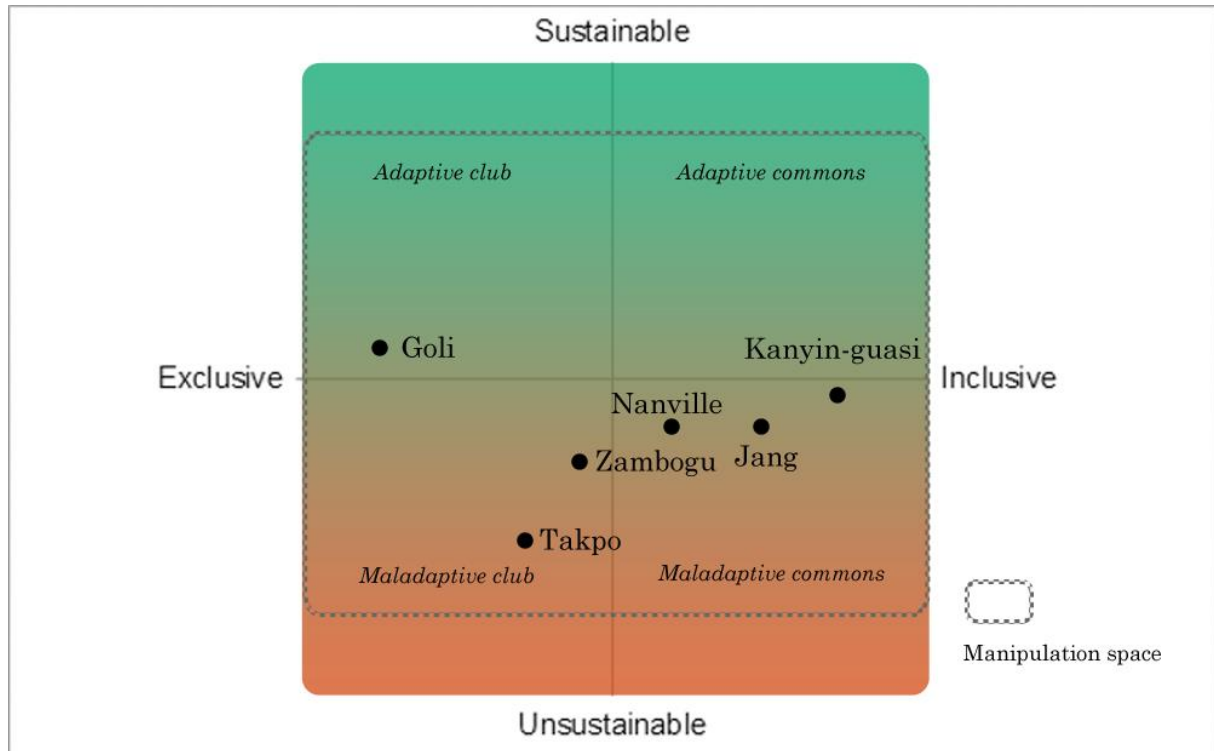


Figure 7.1: SIM model demonstrating the position of each studied APD and manipulation space for external interventions

The dam rated as most sustainable is Goli (meeting 12 manipulatable and 1 non-manipulatable conditions). While Goli is rated as most sustainable, the dam is also the most exclusive. Despite the high socio-economic diversity of the dry season farmers, it is the only area where cattle-owning Fulani pastoralists have been expelled and replaced with Fulani that do not own cattle to drive the village herd. Fulani pastoralists owning cattle coming in from Nator during the dry season are chased out as it often led to destruction of dry season farming crops. Because of the exclusive stance towards pastoralists while the dam is maintained relatively well, the Goli APD usage can be seen as an adaptive club, because only the dry season farmers and livestock owners from their villages benefit. It is clear that the exclusive stance towards Fulani by the community helps them in developing their dry season farming practices, and Goli is now often referred to as the ‘dry season farming wonder’ by local dry season farming project implementers.

Goli is followed up by Kanyin-guasi considering sustainability (meeting 10 manipulatable and 2 non-manipulatable conditions). The difference with Goli is that Kanyin-guasi is much more inclusive towards Fulani pastoralists, where socio-economic diversity of the dry season farmers is high and they allowed a cattle-owning Fulani and Mosi families to settle in their community. As demonstrated, their stance towards Fulani is surprisingly friendly as most of the dry season farmers are happy with their presence. Livestock owners that hire Fulani from neighbouring communities that use the dam are demanded usage and maintenance costs, which seems reasonable as the Kanyin-guasi

livestock owners also contribute. Kanyin-guasi's high score on inclusivity and reasonable score on sustainability brings the APD type close to being an adaptive commons, but it still falls slightly within the maladaptive commons frame as they only meet 12 out of 25 enabling conditions.

While being rated slightly less sustainable than the Kanyin-guasi dam, the Jang community (10 enabling conditions) also has a receptive attitude towards the several Fulani families they host. The dam is however slightly less inclusive as it are mainly the relatively rich that do the dry season farming. In Nanville (10 enabling conditions), it are not the rich but mainly the poor that do dry season farming. However, their very negative stance towards Fulani makes them less inclusive. But as they still both host cattle-owning Fulani while dams do no longer provide sufficient water at the end of the dry season, the Jang and Nanville APDs are both are considered maladaptive commons.

In Zambogo, only 9 enabling conditions are met which is why it is rated as less sustainable, while it does provide sufficient water in the dry season unlike the degraded and overused Jang and Nanville dams. As such, this is already an indication that the enabling conditions as measurement for sustainability do not perfectly reflect reality. Possibly, a differential weighing of the individual enabling conditions may add to a more precise diagnosis of the sustainability of the APDs and other CPR systems. While Zambogo does not have land- or livestock owners that attract Fulani, their similar negative stance towards Fulani also makes them exclusive and their APD system can be seen as a maladaptive club. The Zambogo APD is however more inclusive than the Takpo dam as the socio-economic diversity of farmers is high. Takpo is the most unsustainable (meeting only 7 out of 25 enabling conditions). Despite their hosting of several cattle-owning Fulani families, their very negative stance towards them in combination with very low socio-economic diversity of dry season farmers – who are mainly the rich – makes them more exclusive. The Takpo APD usage is therefore a good example of a maladaptive club.

Finally, the space within which external interventions can manipulate sustainability and inclusivity is outlined in the SIM model. For sustainability, as 20 out of 25 enabling conditions are manipulatable for the studied context (see section 5.9), external interventions cannot manipulate the APD sustainability concerning the 5 enabling conditions. Therefore, these fall outside of the manipulation space, which are the top and bottom regions of the SIM model. The upper and lower limits that interventions can manipulate the APDs delineate the 'manipulation space' for adaptation interventions considering sustainability. However, these non-manipulatable enabling conditions can be indirectly influenced when other enabling conditions are met. For example, advice on locally devised access and management rules can positive have effects on the heterogeneity of endowments and social capital of dam users. The manipulation space for inclusivity on the other hand, is unlimited because the dams have demonstrated that inclusivity varies highly based on the rules that the commons users enforce. These rules are expected to be manipulatable with interventions, such as advising on rules that allow Fulani from neighbouring communities to use an APD.

8. Discussion

In this section, first the various relationships between the enabling conditions for collective action, between sustainability and inclusivity of the studied APDs based on the results are discussed. Second, recommendations are made on what the AF and Ghanaian government should do if the future dams in Northern Ghana are to become more sustainably and inclusively used and managed. Third, the strengths and weaknesses of the SIM model are discussed, as well as the theoretical implications of the research. Finally, it is discussed what adaptation interventions on APDs and CPR systems in general could take into account in order to manipulate maladaptive contexts towards adaptive commons situations.

8.1 The Challenges in Improving APD Systems in Northern Ghana

Most of the dams barely met half of the enabling conditions for collective action, of which many fall under internal and external institutional arrangements. This points towards a more general problem of institutional supply concerning APDs in the studied region. While the decentralization of authority to the local level as from the 1990s in Ghana has given opportunity to APD communities to locally devise access and management rules, it has generally not led to the emergence of such rules, nor their enforcement. Neither local authorities – chiefs, *Tendamba* and landowners – nor the unit committees seen as responsible for dam management have no knowledge on carrying capacities of the dams which makes it difficult for them to match restrictions on harvest with regeneration rates. Even if they would know, restricting harvest – in the form of preventing pastoralists or farmers from using the dams too much – in the absence of low cost exclusion technology and accountable monitors is very challenging.

Important to realize for interventions aiming to improve sustainability of commons through collective action, is that the enabling conditions for collective action do indeed have causal links between them depending on context (as Agrawal 2001 argued). Some relations are obvious, such as when a dam size is small its user group is also small: when too many pastoralists use a dam it dries up, and they resort to other dams. This was the case with the Jang pastoralists moving to neighbouring Zambogo. Another relation is that the presence of appropriate leadership and accountable monitors can give rise to locally devised access and management rules which are actually enforced, as the Goli case demonstrated. The other dams saw an absence of such leadership and monitors, and also had no development in local rules and enforcement of these rules. Most of the dams are used by both socio-economic and socio-culturally diverse dry season farmers and Fulani pastoralists, which is why the heterogeneity of endowments is high. Such heterogeneity however also lead to lower homogeneity of identities and interests, social capital, and a lower overlap of resource location and resource user's residential location. Livestock owner's interests are very different from those of dry season farmers who use the same dams. These dry season farmers simultaneously do not share common identities, interests nor social capital with Fulani pastoralists also using the dams.

If the entities that design and implement interventions in Northern Ghana were more aware of the causal links between enabling conditions and the problem of institutional supply in general, they would be able to design more efficient interventions. As many of the enabling conditions affect each other somehow, the most effective thing to do for interventions is to look at what condition can be manipulated most easily and what support should be given to trigger institutional evolution on different governance levels to improve the conditions more difficult to achieve. For the studied dams, a first step would be that the intervening parties provide information on the carrying capacity of the dams which can lead to locally and regionally devised rules that restrict harvest rates to regeneration rates of a resource.

But before jumping to further policy recommendations and other conclusions on how to make commons usage more sustainable, it is important that the enabling conditions should not be taken blindly as a blueprint for successful adaptation interventions. Improving sustainability by manipulating the enabling conditions tends to promote exclusion of diverse groups that otherwise would benefit from the dams. Indeed, the study has demonstrated with the Goli case that the promotion of power to exclude, of cultural homogeneity between commons users, and of residence near the commons – forming the core of the enabling conditions – can transform open access commons into exclusive club goods that are only used by a selected group of people or ‘lucky few’.

The lucky few that then form the adaptive or maladaptive club in the studied APD system are either a selective group of livestock owners or dry season farmers which tend to mutually exclude one another. When livestock owners dominate the utilisation of a dam, as the Takpo dam case illustrated, the increasing cattle numbers and resulting crop damages lead to the collapse of dry season farming. What happens is an unintended promotion of livestock production through constructing APDs, resulting in reproduction of crop destruction up to a point that the farmers give up using the APD. Investments in cattle or obtaining cattle from settling Fulani by local landowners and other elites in APD communities bring them quick profits, at the cost of the development of dry season farming. Such a vicious circle appears to be an important issue that adaptation interventions on APDs need to be aware of. As the Goli case has demonstrated, another possibility is that influential dry season farmers dominate the utilisation of a dam, leading to exclusion of Fulani pastoralists from using the dam. While the dam is sustainably used and managed by a few wealthy farmers, Fulani pastoralists are effectively excluded from using it for their cattle. According to the enabling conditions the Goli dam is most sustainable, which it indeed seems to be in reality when looking at maintenance activities and the current state of the dams.

While promoting such exclusive adaptive club-like APD situations, the enabling conditions *overlook the unsustainable consequences of the exclusion it promotes in the name of sustainability*. What does that mean? Either farmers cannot utilise the dams due to livestock owner dominance (think of Takpo), or the Fulani settled in these and neighbouring communities are not allowed to use the dam due to farmer dominance (think of Goli). Perhaps not coincidentally, especially in the farmer-dominant Goli area there were reported cases of armed robbery by settled Fulani. Some outside Fulani argued that because they were not allowed to own cattle, they ‘had nothing to lose’. Cattle-owning Fulani settled in neighbouring communities such as Nator resort to using other dams where communities do not exclude them, such as Takpo and Nanville, consequently leading to farmer-herder conflicts and water overuse in these areas. The sustainability of the Goli dam therefore comes at a cost: other dams are overused and conflict has moved there while the water in the sustainable Goli APD remains underutilized. Policy recommendations therefore should not blindly promote the theoretical enabling conditions for collective action, but simultaneously incorporate the internal and external consequences of promoting the power of a certain group of dam users to exclude others from using ‘their’ water and land commons.

Manipulating APDs into becoming ‘adaptive commons’ also does not mean that the dams should be completely open access, where any Fulani pastoralist is free to use the dams without any constraints. Such a scenario would most likely also lead to conflict and overuse of APDs, as the Nanville and Jang dams have demonstrated. Instead, due to the mixture of seasonal users (Fulani pastoralists from outside of the beneficiary communities) and permanent users (dry season farmers and settled Fulani pastoralists) of APDs, more dynamic forms of exclusion are needed depending on season and water availability in the dam and in other APDs elsewhere in the region. APD governance should include arrangements allowing Fulani pastoralists from outside to use the water while not overusing it, to

oblige them or the livestock owners that contracted them to contribute to APD maintenance. The Kanyin-guasi dam provides an example of such a more inclusive situation. Albeit not a very sustainable dam according to the SIM model, it is much more seasonally utilized by diverse groups which are hardly in conflict: both socio-economic diverse dry season farmers and any (migrant) Fulani in search for water during the dry season. Cattle corridors have been provided, livestock owners contribute to APD maintenance, and livestock owners from outside have also been requested to contribute to maintenance. Perhaps not coincidentally, farmers-pastoralists relationships are much more cordial and cooperative in the Kanyin-guasi area.

8.2 Recommendations for Future AF and “One Village, One Dam” Projects

If the future APD constructions resulting from the AF projects and “One Village, One Dam” policy in Northern Ghana wish to contribute to more sustainable and inclusive dam usage, several issues need to be taken into account. Both farmers and pastoralists need to be included in using and managing dams, leading to more APD sustainability and less conflict on a regional scale rather than on a local scale. More inspiration needs to be taken from more inclusive Kanyin-guasi-like scenarios of adaptive commons rather than currently idealized exclusive Goli-like scenarios of adaptive clubs. Then what could the AF in the Nadowli region and elsewhere in Northern Ghana do? Most advisable is a combination of focusing on the most easily manipulatable enabling conditions to tackle the problem of institutional supply, while also promoting inclusivity rather than excludability of APDs. This means that socio-economic diverse dry season farmers and Fulani pastoralists should both be able to access and manage dams in recipient regions. Primarily improving water abundance, as the current AF and “One Village, One Dam” project seek to do, is therefore nowhere near a sustainable intervention. Apart from increasing water abundance, the projects could

- Formulate agreements on who has the right to use the water and for what costs – including Fulani settled in the community and in neighbouring communities. Maintenance work or small fees could be demanded by elected unit committees from any APD user.
- Organise elections for ‘dam leaders’ who chair dam committees. They should have strong connections with diverse dam users and the local traditional elite. Dam committees should include people that use the dam for different purposes and preferably college graduates and influential elders. Leaders should be chosen on majority vote by the dam users every 1-3 years.
- Involve socio-economically diverse dry season farmers in using dams – provide support for farming inputs for poorer farmers, widows and other vulnerable groups.
- Involve communities without dams that neighbour communities with dams in dam usage (such as Nator, Kpaddinga, Naro). Livestock owners and Fulani from neighbouring communities that are interested in using the dam should be involved in dam usage and management, and contribute if they use the dam.
- Provide to the dam leaders and management committees scientific information on carrying capacity, regeneration rates and maintenance requirements for the dams.
- Advice on possibly gradual sanctioning methods if people misuse the dams or do not contribute to maintenance. A small sanction can be small money fees, and more severe sanctions can restrict dam usage.
- Advice on rotational schemes of monitoring by those that use the dam themselves for both farming and livestock

- Establish regional dam committee representing every dam of the region to discuss dam access by communities without dams and seasonal Fulani users. Agree on regionally coherent contribution/payment requirements for dam usage
- Appoint cross-communal cattle corridors to APDs, so as to enable Fulani pastoralists to use different dams across the region
- Invest in irrigation infrastructure that can be maintained by the dry season farmers. While there is generally sufficient water in the APDs, they mainly need functioning infrastructure to move the water onto the plots through for example furrows in combination with shallow wells. Irrigation with buckets is seen as too labour intensive for most potential dry season farmers which is why it is a major hindrance to further development

8.3 Theoretical Implications and Reflections on the SIM model

The results of this research show that widespread promotion of excludability of a resource and cultural homogeneity of users in the name of sustainable commons governance brings forth adaptive club types of usage. Such adaptive club communities are sustainable on itself, but impose externalities on the region in which they are situated. In the context of Northern Ghana and possibly many other regions in West Africa, excluding cattle-owning Fulani pastoralists from using dams leads to conflict and overuse elsewhere. Rating the sustainability of a resource by only using the enabling conditions for collective action which the SIM model did – such externalities may be overlooked. The observed externalities expose the limitations of the theoretical enabling conditions for collective action from commons theory. The northern Ghanaian agro-pastoral context has demonstrated that pushing for the enabling conditions for collective action with the higher goal of becoming sustainable CPR systems, this may be efficient on a local scale but go at the cost of sustainability of adjacent CPR systems.

As the proposed SIM model uses the enabling conditions for collective action to determine sustainability of CPR systems, the first weakness of the SIM model is that it does not incorporate the observed negative externalities of adherence to these enabling conditions. The model uncritically uses the enabling conditions as a blueprint to rate the sustainability of CPR systems. The second weakness of the SIM model is that all the enabling conditions have been weighed equally for the purpose of analysis. This is a strong simplification of reality, which is why the SIM model had difficulties in exposing differences in sustainability between APD usages that adhered a similar number of enabling conditions. Possibly, as suggested before, a differential weighing of the individual enabling conditions may add to a more precise diagnosis of the sustainability of the APDs and other CPR systems.

Despite these weaknesses, the SIM model has proven to be capable in exposing relationships between sustainability and inclusivity of CPR systems. In this research, the supposedly more sustainable CPRs are the ones that tend to exclude certain users. In that sense, commons theorists are right for the context of this study: exclusion is indeed strongly related to – and perhaps a requirement for – sustainability of a CPR system. In the studied area, exclusion takes place in two forms: One, dry season farmers were excluded due to the extensive crop damages done by increasing cattle numbers owned by local elites and Fulani pastoralists in a dam community (Takpo). Two, in another case Fulani pastoralists were not allowed to own cattle and Fulani from outside the village territory were fenced off to use the dams in order to protect the dry season crops (Goli). Exposing these forms of exclusion, the SIM model reaffirmed that ‘the empowering of communities and high self-reliance does not automatically promote sustainable management or lead to the inclusion of the most vulnerable’ as pointed out by Tacconi & Tisdell (1992) and Pelling (2003). Such exclusions taking place adds a perversity to CBA interventions such as building communal APDs: in this study, local elites often benefit most from the dams as they are livestock owners that can utilize the water efficiently while

they can also decide whether Fulani pastoralists can use the dam. Or in more exceptional cases, locally powerful dry season farmers benefit most by excluding pastoralists from using the dam. Such exclusions do not only lead to the mentioned unsustainable externalities onto other dams in neighbouring communities, but also to inequality and social tensions within a community. In a community where Fulani were not allowed to own cattle and fit the ‘exploited tenants’ characterisation, dry season farming thrived while there were increasing cases of armed robbery by Fulani from that area (the Goli community). In a community where Fulani with many cattle were allowed and bribed local authorities for their stay, the development of dry season farming collapsed due to extensive damages done to fences and crops (the Takpo community).

8.4 Dynamic Inclusion as a Means towards Adaptive Commons

Then how can CBA interventions in general contribute to sustainable commons management in contexts where commons are aimed to be used for cultural heterogeneous, socio-economically diverse multiple user groups where, according to Bardhan & Dayton-Johnson (2002), costs of negotiation and bargaining inherent in the process of crafting commons institutions are high?

Firstly, CBA interventions on APDs in West Africa should be complemented with advising and lobbying for regionally coherent forms of exclusion and inclusion concerning resource use by the Fulani pastoralists. They could be seasonally included in regions with APDs depending on the water availability of each APD and surrounding pasture. The APDs should neither be open access without institutional arrangements (which is now often the case), nor should pastoralists be rigidly excluded (which is now sometimes the case), because both such scenarios lead to conflict and overuse concerning APDs within a region. In order to become ‘adaptive commons’, the APDs require dynamic forms of inclusion which incorporate contributions from both farmers and pastoralists to use and maintain a dam, maximum numbers that can use dams based on carrying capacities, and allow dam access based on water availability in other APDs in the region. If for example a dam’s water levels turn very low, pastoralists could be incentivized to use dams elsewhere in the region where water may be underutilized. This study has demonstrated that regional uneven utilization of dam water is a result from a lack of coherence in Fulani inclusion. Think of the overused open access Nanville dam located nearby the underutilized rigidly exclusive Goli dam. The cross-communal movement of settled Fulani in a region could be stimulated by allocating cattle-corridors to APDs.

Secondly and related, adaptation interventions could provide support to developing local and regional institutional arrangements. Currently, they mainly focus on hardware, in order to increase water abundance with dams while downplaying the problem of institutional supply. The studied region in Northern Ghana has once again demonstrated that the hardware provided by adaptation interventions – APDs – cannot be used sustainably in the absence of institutions that include multiple user groups in commons use and management. Therefore, interventions should incorporate a regional institutional focus as part of their implementation process. The problem of institutional supply in such contexts needs to be challenged with adaptation interventions that support local and regional arenas of discussion and deliberation where multiple stakeholders are represented on multiple scales (as also proposed by Ayers 2010). With contemporary CBA projects the ‘software’ problem of institutional supply is already supported by appointing local management committees that are supposed to monitor the resource and organize collective action. This study has demonstrated that these appointed people often do not feel this responsibility because often they have not made personal investments in the dam nor use it themselves. For Northern Ghana, the persisting problem of institutional supply was demonstrated for the studied dams where there are ‘in principle dam committees, but not in practice’.

9. Conclusion

From the lessons in northern Ghana, it is clear that CBA interventions on APDs in northern Ghana face several challenges if these are to become more sustainable and inclusive in the future. Also current commons theory that seeks to promote community empowerment in order to exclude others from using ‘their’ APD faces new challenges. In the northern Ghanaian context, excluding certain users from APDs appears not to be always desirable at all. When empowering communities to exclude, the research has shown that it may lead to overuse and conflict in adjacent APD systems. Either dry season farmers are excluded due to increasing cattle pressures on land surrounding APDs, or to pastoralists due to ejection of cattle-owning Fulani settlers in communities. As such, this finding contradicts most commons theory, which suggests that excluding certain users may bring sustainability to an APD system. Therefore, solely seeking to improve sustainability using the enabling conditions for collective action provides no solution towards sustainability on regional scales. The enabling conditions for collective action tend to overlook the unsustainable externalities of the exclusion it promotes. Such exclusion is especially problematic in northern Ghana, where APD commons scattered in the landscape are available to use by mobile pastoralist groups. Promoting the enabling conditions for collective action as a blueprint for sustainability for APDs in northern Ghana is thus a mistake. While providing rich insights on relations between sustainability and inclusivity of APD systems, the proposed SIM model made this mistake by uncritically using the enabling conditions for collective action when rating sustainability in its diagnosis of APDs. Possibly, a differential weighing of the individual enabling conditions may add to a more precise diagnosis of the sustainability of the APDs and other CPR systems. Further theoretical development of the enabling conditions for collective action is needed to improve current commons theory, that fits regions with culturally heterogeneous and mobile user groups of CPRs.

Apart from these theoretical challenges, the main research question is of more of a practical nature: how can adaptation interventions on APDs contribute to more sustainable and inclusive APD usage in northern Ghana? The findings have shown that excluding either pastoralists or farmers is no solution for sustainable APD usage, nor is it inclusive. Should the APDs in northern Ghana remain open access instead? Probably not, as the assertion of commons theory that open access may lead to overuse and conflict has been reconfirmed by this study. The studied open access APDs are unsustainable as these are often overused by pastoralists and prone to degrade in a context with limited institutional arrangements. Current Ghanaian adaptation discourse still sees improving water supplies through open access APDs as a magic bullet to overcome resource-related conflict and overuse. After two decades of continued establishment of open access APDs in northern Ghana, Fulani-farmer conflicts concerning land and water use continue up to today. The new “One Village, One Dam” governmental flagship project is therefore not likely to improve these issues if it only focuses on improving open access water supply. Let it therefore be clear that completely open access APDs are also no solution towards sustainable and inclusive usage and cooperation between farmers and pastoralists. Hence, the study has demonstrated that both rigid exclusion of certain groups on the one hand, and unbridled open access to an APD on the other hand do not lead to sustainable and inclusive APD usage. Then what should be done instead?

A middle ground needs to be found, where APDs are neither completely open access nor rigidly exclusive. Regionally dynamic forms of inclusion and exclusion of Fulani pastoralists are needed, which based on water and pasture availabilities. These can develop if future CBA and other interventions on communal APDs complement their efforts with the development of local and regional institutional arrangements. Institutional arrangements can develop if adaptation interventions on

APDs ensure that water and land users are represented by local committees and leaders, who are nested in regional APD arrangements that result in regionally coherent forms of inclusion and exclusion that synergise with regional water availabilities. For example, the movement of settled Fulani in a region could be managed by allocating cross-communal cattle-corridors that encourage pastoral movement towards erratically available APDs and other sources of pasture and water.

In order to develop such regional arrangements, deliberative arenas of discussion and dialogue between farmers and Fulani pastoralists need to be promoted. Such a dialogue can only develop if the discourse of the Ghanaian government in its adaptation policy changes its current hostile rhetoric towards Fulani pastoralists into a discourse that acknowledges their important role in the usage and management of water and land CPRs throughout northern and central Ghana. When acknowledging Fulani pastoralists within the adaptation discourse, interventions need to be aware that cooperative structures between Ghanaians and settled Fulani pastoralists are often more diverse than portrayed. The common portrayal in development literature of Fulani pastoralists as a marginalized, vulnerable and poor group desperate to find pasture and water is highly inaccurate. While this is true in some cases, in other cases they can also be wealthy free riders that use diverse strategies, such as bribing local authorities and livestock owners to gain access to the common land and water in new territories they enter. Recognition of the diversity in wealth and strategies of Fulani pastoralists to gain access to the APDs and other commons is of prime importance to include them in land and water usage and management. By taking these diverse issues into account, more sustainable and inclusive use of APDs may develop where pastoralists and farmers cooperate instead of compete. Only then, APDs can develop towards becoming adaptive commons that are used sustainably and simultaneously by Fulani pastoralists and farmers. Such sustainable development is direly needed in northern Ghana and probably many other regions in semi-arid West Africa, which face a likely future of increasing pressures on the remaining land and water commons.

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Appendix I: Interview question lists

General questions

Questions about characteristics of the resource and its user groups

- Which villages use the dam, are they allowed
- Is it clear who is allowed to use it and who not?
- Any other villages that use it sometimes / or people that are not allowed?
- Do the user groups share the norms considering usage?
- How close/together feel the farmers and livestock owners?
- Are there leaders that determine how the CPR is used and are they connected to the local elite and other externals?
- To what extent the resource users dependent on each other in how they use the resource?
- Do the resource users possess different endowments that can be transformed into economic capital?
- To what extent have the resource users the same identity and interests in resource use?

Questions about group-resource system relations

- Do the resource users live nearby the water/land?
- Do the users depend mainly for their livelihood on the resource?
- Is the allocation of the resource considered fair?

Questions about institutional arrangements

- Are there locally devised access/management rules? What are these?
- Are the rules simple and easy to understand?
- How are the rules enforced and how easy is this?
- Are there graduated sanctions in place, and what are these?
- Are offenders brought to justice, how and at what cost?
- How is the resource monitored, and are these monitors and other officials accountable?
- Are there restrictions on harvest that match with regeneration rates?

Questions about the external environment of the locality

- How and at what cost are other users excluded? High or low cost?
- Does the government undermine the local authority? How?
- Are there supportive external sanctioning institutions? Which?
- (Do users get appropriate levels of external aid to compensate for conservation activities?)
- To what extent are the appropriation, provision and enforcement governance nested in different levels?

Questions on inclusion/exclusion

- Who and to what extent are some people excluded from using or included in using the resource?
- How is this done?
- What has lead to this situation?
- Is there any discussion with the excluded group? Does this lead to involvement in decision making?
- Is there any third party involved that promotes communication between the different user groups?
- How do you think others can be included (if they are (attempted to be) excluded)

Fieldwork round 1: Fulani pastoralists and Ghanaian Farmers

Question list Fulani herders

- How long have you been here, where did you come from, why did you come here.
- How did you arrange to settle here
- When you came here, did you own livestock. Do you own livestock now, is it expanding
- How many children do you have, how many go to school
- Where do you graze, are you allowed to graze there, do you compete with other herders or do you cooperate
- Is there sufficient pasture, what do you do if not.
- Where do you get water, is it allowed, is it sufficient. What do you do if it is not.
- Have you ever had issues with farmers, example, what happens, are they settled, and if so how
- Does your landlord choose your side in conflicts or not.
- Have you ever had issues with police
- Do you know the natives well, when do you meet.
- Do you know the other Fulani well, when do you meet.
- Any issues that you wish to tell me about

Question list Ghanaian farmers

- How long have you been farming, do you do dry season farming, how long
- Do you have other sources of income
- Do you own livestock, if yes, who rears it, and where.
- Do the children go to school. What activities has your wife.
- Which water body do you use for farming (and livestock)
 - o how long has it been there
 - o how is it maintained
 - o are there rules for usage, which ones and do you think they're fair, how are they monitored and enforced, are offenders brought to justice and how, are there restrictions on harvest
 - o are there sanctions for if someone breaks the rules
- Is there Fulani living in the community, if yes why and what do think about it. If no, how were they expelled and why.
- Are there ever Fulani grazing nearby, are there ever issues with them, what happens and how is it solved
- Do the landlords choose their side in any conflict with Fulani
- Are you paid compensation when crops are destroyed
- Are there rules for using the water, what is done if the levels have low.
- Are Fulanis allowed to access the water, how is this enforced.
- Are Fulanis allowed to use the pasture in the community.

Fieldwork round 2: Landowners/dam committee/livestock owners

- How have relations between farmers and herders changed after the construction of the dam
- Do they feel less close/together than before
- Has its presence attracted Fulani / livestock owners
- How have relations changed with neighbouring villages
- Who benefitted most of the dam? Who not?
- Is this seen as fair by the users? Are the benefits allocated fair?
- Are there defined boundaries where there can be dry-season farming
- Who owns the land for dry season farming
- Are there defined boundaries what pasture area belongs to the village and what to surrounding villages

- Are herders aware of these boundaries
- If cattle destroys the farm, does the livestock owner pay compensation – increasing gradually?
- Who settles conflict, is it independently done? Unbiased? (Chief?)
- Who has in principle authority over the dam, who is seen as the leader, what activities do they do in practice
- Is this authority ever undermined by anyone or the local government
- Who are in the unit committee of the dam, how many, how often elected
- Are the different users (pastoralists, dry season farmers, women) represented?
- What do they do in practice
- Who monitors the condition of the dam, are these accountable
- How many landowners (*Tendamba*) are there in the village
- Who owns the area of dry season gardens
- Who else decides over how land is used
- Who monitors the condition of the pasture, are these accountable
- To what extent can the chief decide that Fulani are expelled with the landowners
- To what extent can the local government decide that the Fulani are expelled
- To what extent can the chief / local government decide over livestock owners cattle
- What arrangements are made with neighbouring villages
- Are these arrangements supported by the local government / police
- What arrangements are made with neighbouring districts (question for government)

Appendix II: Planning

Activity	Date
Starting date thesis	November 15
Preparation and writing research proposal	November 15 – December 27
Arrival in Accra, Ghana. Travelling to and settling in Wa.	December 28 – January 5
Exploratory research on Adaptation Fund activities, exploratory interviews conducted with stakeholders (EPA Ghana district director, and two District Assembly directors)	January 5 – 20
Adjustment of research proposal	January 20 – January 30
Several meetings with supervisor, discussions on adjustment research proposal (15 supervision hours). First interviews with 7 Fulani herders and 2 Fulani women, and a focus group with 4 households in proximity of 3 Ghanaian farmer communities.	February 1 – 6
Finalization of updated research proposal, processing of first interviews.	February 7 – 9
Interviews with 6-8 Ghanaian farmer households in the same 3 farmer communities	February 10 – 12
Processing of Ghanaian farmer interviews. Attend meeting on CARE's Adaptation Learning Program (ALP) and Adaptation Fund discussion in Tamale (2 supervision hours)	February 13 – 15
Interviews and a focus group with 6-10 Fulani herders and women living near other AF recipient communities	February 16 – 19
Processing of Fulani interviews	February 20 – 22
Interviews and a focus group with 6-10 Ghanaian farmers and women living in the same communities	February 23 – 26
Processing of farmer interviews	February 27 – March 1
Visit & live with one of the previously interviewed Fulani families	March 2 – 10
Reflect on data gathered so far from the interviews and the Fulani visit.	March 11 – 12
Formulate survey for Ghanaian farmers	March 13 – 14
Conduct survey	March 15 – 25
Travel back to Accra, then travel back to Utrecht	March 26 – 29
Settle back in Utrecht, visit family & friends	March 30 – April 2
Process survey data	April 3 – 5
Analyse interview & survey data using transcriptions and SPSS	April 6 – 10
Write draft empirical chapters	April 11 – April 15
Update and write theoretical chapters	April 16 – May 5
Write draft contextual chapter	May 6 – 12
Write draft introduction, discussion and conclusion	May 13 – May 20
Request feedback on first draft version thesis and process feedback (10 supervision hours)	May 22 – June 5
Write second draft thesis and prepare thesis presentation IAC conference	June 5 – 17
Request & process feedback on second draft thesis, finalize thesis (5 supervision hours)	June 18 – 29
Attend IASC 2017 Biennial Conference, present brief thesis results at panel discussion. Final thesis reflection with supervisor.	10-14 July
Hand in thesis	14 July

Appendix III: Questionnaire Dry Season Farming, Water Dam Use and Fulani issues

1. Sex F / M

2. Are you a widow? YES / NO

3. What is your level of education? **Underline:** Primary school / JHS / SHS / Tertiary

4. How long have you been doing dry-season at the current location?

5. If you have farmed on another location, for how long did you do that?.....

6. How long does it take you to reach the garden? **Underline:** Up to 15 min / Up to 30 min / Up to 1 hour

7. How do you travel to the dry-season gardens? **Underline:** On foot / Bicycle / Motorbike / Motorking

8. Do you use any fertiliser, pesticide or any kind of chemical? YES / NO

9. What is your source of water for dry-season farming?

Underline: Dam / Dugout / Borehole / Other:.....

10. How do you mainly water your crops? **Underline:** With pumps / With buckets /

Other:.....

11. Which vegetables do you grow? **Tick one or more:**

- | | | |
|---|---------------------------------------|--------------------------------------|
| <input type="checkbox"/> Pumpkin leaves | <input type="checkbox"/> Beans leaves | <input type="checkbox"/> Salad |
| <input type="checkbox"/> Other local leaves | <input type="checkbox"/> Tomatoes | <input type="checkbox"/> Peppers |
| <input type="checkbox"/> Cabbage | <input type="checkbox"/> Carrots | <input type="checkbox"/> Watermelon |
| <input type="checkbox"/> Onions | <input type="checkbox"/> Sugarcane | <input type="checkbox"/> Other:..... |

12. How do you sell your vegetables? **Underline:** Market in my community / Market in neighbouring community / Market in town (Wa, Nadowli, Kaleo) / Other:.....

13. How much time do you spend in the garden? **Underline:** I don't go every day / I go there every day in the morning / I go there twice a day / I spend most of the day there

14. Where do you get the seeds for your crops from? **Underline:** An NGO provides them / At the local market / In a bigger town (Nadowli, Wa) / Local Government / Other:.....

15. Is/was your dry season farming plot fenced? YES / NO

If YES what material was the fence made of? **Underline:** iron/wood/fence plants

If NO, is/was the farm guarded at night YES / NO

16. If YES, Who made the fence for your garden? **Underline:** Myself / An NGO or Government / My husband or wife / Hired workers / Other:

17. Do you think the benefits from the dam are distributed fairly to all people? YES / NO

18. Do you need the dry season farming to maintain your livelihood? YES / NO

19. Who owns cattle and use the Fulani to rear them? **Underline those that own cattle:**

The chief / The main *Tendamba* / Other landowners (Tindeme) / People that do not own land

20. Are you happy as a dry season farmer with the presence of Fulani herding YES / NO

21. If NO happy, why not? **Tick one or more:**

- Because they destroyed my crops
 - Because I don't get enough compensation when my crops are/were destroyed
 - Because they are criminals in general
- Other reason? Fill in:

.....
22. Have you ever had a conflict with the Fulani settled in your community? YES / NO

23. Did your crops ever get destroyed? YES / NO

24. If YES, did you get sufficient compensation? YES / NO

25. Do you want the Fulani to be sacked/replaced? YES / NO

26. If YES, then why are they not sacked/replaced? **Fill in:**

.....
27. If YES, would you prefer to sack or replace them? **Underline:** sack / replace

28. If NO, why do you not want them to be sacked?

- Because they are needed to rear the cattle owned by chief/*Tendamba*/tindeme
 - Because they are needed to rear the cattle owned by other villagers
- Any other reason? **Fill in:**

.....
FOR THOSE THAT USE OR USED THE DAM

29. Are some farmers richer than others, and make investments for water supply? YES / NO

30. Who do you think is responsible for taking care of the dam and water supply to the farms?

Underline: Local Government / NGO / Unit or Dam Committee / We Farmers / Other:.....

31. Have you ever contributed to constructing or repairing the water supply? YES / NO

32. Has there been sufficient communal labour to maintain the water supply? YES / NO

33. If YES, did the labour help to keep the water supply working? YES / NO

34. If NO, why was the communal labour never organized or not sufficient? **TICK ANY:**

- Because an NGO should help us
- Because the local government should help us
- Because the dam is that not important to me
- Because we don't know how to repair it ourselves

Any other reason? Fill in: