Agriculture, Water, Climate and Migration in semi-arid lands in Burkina Faso
Report
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Peter Newborne and Noël R. Gansaonré

This report was written by Peter Newborne, Research Associate to the Overseas Development Institute (ODI) and Noël R. Gansaonré, researcher on natural resource management and expert statistician based in Ouagadougou, Burkina Faso. It is one of a series of reports for ‘PRISE’ – ‘Pathways to Resilience in Semi-arid Economies’ - which is a five-year, multi-country research project that generates new knowledge about how economic development in semi-arid regions can be made more equitable and resilient to climate change.

PRISE aims to strengthen the commitment of decision-makers in local and national governments, businesses and trade bodies to rapid, inclusive and resilient development in these regions. It does so by deepening their understanding of the threats and opportunities that semi-arid economies face in relation to climate change.

The PRISE consortium comprises the Overseas Development Institute (lead), UK; Grantham Research Institute for Climate Change and the Environment, UK; Innovations Environnement Développement en Afrique, Senegal; and the Sustainable Development Policy Institute, Pakistan; with, as country research partners, the Regional Environmental Centre for Central Asia, Tajikistan, the Kenya Markets Trust, Kenya, the University of Ouagadougou, Burkina Faso and the University of Central Asia, Kyrgyzstan.

Front cover image:
Vegetable gardens by a local reservoir in Burkina Faso.
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This report was written by Peter Newborne, Research Associate to the Overseas Development Institute (ODI) and Noël R. Gansaonré, researcher on natural resource management and expert statistician based in Ouagadougou.

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‘PRISE’ – ‘Pathways to Resilience in Semi-arid Economies’ – is an applied research project that aims to catalyse inclusive climate-resistant development in semi-arid lands (SALs). The vision of climate-resistant development of PRISE is of inclusive development that both eliminates poverty and maximises people’s capacity to adapt to climate change. This requires – a hypothesis of the PRISE project - a ‘change in mechanisms of economic growth and social development, including institutional and regulatory frameworks, markets and bases of human and natural capital’.

The report’s findings and conclusions are those of the authors and do not necessarily reflect the positions or policies of IDRC/DFID. For more information, contact Peter Newborne (p.newborne.ra@odi.org) or Guy Jobbins (g.jobbins@odi.org.uk).
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This project has studied how agricultural communities in the semi-arid central plateau of Burkina Faso - an area of high food insecurity - are managing available water and land resources in changing climatic conditions. A total of 207 farming households in eight villages in the area around the Ziga dam and reservoir on the Nakambé River were consulted, by quantitative survey and by discussions with focus groups of men and women.

These communities are managing by ‘exporting’ for six months of the year their prime male labour force to take part in agriculture elsewhere. Nine out of the ten persons questioned reported that a member or members of his/her family had migrated out of the locality (in total 547 persons had left from the 207 households surveyed, i.e. on average 2.6 persons per household). The departures are a necessity more than a choice: agriculture in/ around the home villages does not provide enough for food needs.

The migrants spend six months of the year away, leaving in October/November and coming back in March/ April. Their destination is, in many cases, rural locations within Burkina Faso where there are opportunities to use irrigation waters to grow fruit and vegetables – near water bodies, e.g. dams, large, medium and small. While, in this way, the majority of migrants make use of their skills-base in agriculture, a few family members migrate to urban areas, particularly Ouagadougou, where they work in construction or other commerce. More men, a focus group said, would go to the city ‘if they xhad the relevant skills’.

Among the problems faced by the local agriculture, lack of access to water for irrigation was rated as ‘very important’ by 98% of persons interviewed, alongside poor/degraded soils at 90% as well as drought and irregular rainfall at 85% and 83% respectively. The rains begin later and stop sooner which makes for nine dry months of the year. When the rains do come, they are more unpredictable. The intense dry periods that the Ziga communities have observed over the past 15 years and more are becoming more prevalent.

The migration causes a big upheaval. With husbands, brothers, sons away for half the year, the women are left to carry a very heavy work load. As well as caring for children and aged parents and carrying out household tasks, they have to try to combine additional income earning activities in addition to looking after livestock (goats and poultry). The small business ventures referred to in the focus groups include making foods and preparing drinks for sale (e.g. millet beer), fabricating ropes and baskets or soap, or producing clothing, or setting up cafes at the road-side. In two villages, the women are extracting sand and breaking up stones/rock to make gravel for sale. It is hard labour which, they said, makes them tired and more prone to illness. Despite their good humour and endurance, it is clear that they particularly are enduring the current predicament of their communities. The difficulty is made worse by poor roads and remoteness (‘enclavement’ in French). The overall impression is of great community vulnerability.

This situation in which the Ziga communities find themselves is both special and typical. It is special in the sense that the communities did have ready access to water in the past before the dam flooded the valley bottom, and do not now. The water in the Ziga reservoir is reserved for supply to Ouagadougou. The communities upstream of the dam are prohibited access because irrigation would pollute the lake with chemicals from fertilisers and pesticides making the water prohibitively expensive for the urban water company, ONEA, to treat. Meanwhile, the communities downstream of the dam have some limited access.

The situation, meanwhile, is typical in that it illustrates the difficulties faced by rural communities in Burkina Faso who have to rely on rain-fed agriculture. Even using techniques such as stone bunds (cordons pierreux) and zaï for retaining the humidity in the soil, rain-fed agriculture in semi-arid areas is a struggle, especially in the context of a shortage of labour.

The Ziga communities understand the ban on irrigation on the shores of the reservoir. It is the lack of other, small irrigation infrastructure of which the villages complain – the lack of support to them in terms of works ancillary to the main dam. ‘Where’, the villagers say, ‘are the small dams we were promised?’

Documented examples of other communities in Burkina Faso and elsewhere in West Africa show how the construction of small, built water storage infrastructure can help local development. For example, a 2014 study of four sites in Burkina Faso showed how small dams/ponds increased agricultural production, for the purposes of subsistence and of sale (where there was market access). In Burkina Faso, since 2015 the term ‘small dam’, according to the definition of the National Dams Committee (le Comité National des Barrages du Burkina) (source: CNBB, 2015), refers to dams of between 2 and 5 metres in height. In comparison, the small scale water infrastructure examined in the above 2014 study was lower in height (around 1 metre), i.e. strictly (since 2015) a ‘retenue d’eau’ (pond).
The question, therefore, arises where small dams/ponds fit in the strategies of the Burkina Faso government. The National Plan for Economic and Social Development 2016-2020 (PNDES) sets out the government’s ambition to increase the contribution of irrigated agriculture to overall national agricultural production from 15% in 2015 to 25% in 2020. According to the Facebook page of the Ministry of Agriculture (on April 12th, 2017) and subsequent reports in the Burkinabé press, the Ministry is to lead a donor-funded project to map (in digital form) suitable sites to be part of a national programme for development of les bas fonds. The mapping will take two years and the goal of the programme to 2030 will be ‘to secure agricultural production, strengthen food security and promote economic growth’.

In developing national capacity for water storage matching supply to demand, a combination of small and larger reservoirs, alongside aquifers, is important as part of an integrated water management system. Economies and societies that mobilise a mix of complementary storage options are more likely to be more adaptable to demand than those based on a single storage type. Small reservoirs can be sited (very) close to their points of use with, as a consequence, good responsiveness to local demands – where the design and construction is sound and where appropriate means of management and maintenance are put in place. The length of time these small reservoirs/ponds retain water will vary according to local conditions, depending on the type of soil and the rate of evaporation, as well as the size of the reservoir/pond and the pace of water extraction for irrigation. In the Ziga area, small reservoirs/ponds are capable of retaining water for 4/5 months after the end of the rainy season, from October/November until February/March allowing for double-cropping (in the dry as well as rainy season). More investment in this type of small-scale built infrastructure in the bas fonds of Burkina Faso is needed - where local conditions are suitable - accompanied by measures such as support to farmer organisations, training on marketing and strengthening of capacity in infrastructure maintenance.

For the villages in the area around the Ziga dam the key question is whether their area will be included in this mapping by the Ministry of Agriculture and whether subsequently the authorities, and donors, will fund investments in small dams to benefit those villages. The Ziga communities certainly need such support.
The study

1.1 Context of study

This is the report of research carried out for the ‘PRISE’ project – ‘Pathways to Resilience in Semi-arid Economies’ – in Burkina Faso in West Africa. The PRISE vision of climate-resilient development is of inclusive development that both eliminates poverty and maximises people’s capacity to adapt to climate change.

The research focuses on rural communities in the central plateau of Burkina Faso. The north of Burkina Faso is arid (‘Sahel’) with typically average annual rainfall of less than 600 mm. The centre is the semi-arid zone (‘soudano-sahelian’) with average annual rainfall of 600-900 mm. The south is a dry and sub-humid zone (‘soudanese’) with average annual rainfall of 900 mm (Wetta et al., 2015). These three climatic zones are shown on the map in Figure 1.

Figure 1: Climatic zones of Burkina Faso

The research aims to better understand how agricultural communities in the semi-arid zone are managing available water and land resources in changing climatic conditions.

Burkina Faso has two seasons: a long dry season and a short rainy season. In the semi-arid central zone, the rainy season is about five months, typically from May/June to September/October. In the arid Sahel in the north, the rainy season is typically shorter – about four months at most. In the southern zone, the rainy season lasts nearly six months (Wetta et al., 2015). The past three decades have, however, seen signs of increasing variability in rainfall distribution, temporal and spatial, manifested by shorter and more unpredictable rainy seasons (Wetta et al., 2015; FEWSNET, 2012). This has serious implications for agriculture in Burkina Faso which is mainly rain-fed. A key issue for this research has been whether farmers in the central semi-arid region are indeed experiencing shortening of the rainy seasons and, if so, what that means for them and their families.

It is uncertain whether these trends are exacerbated by climate change attributed directly or indirectly to human activity or whether they are a feature of natural climate variability. The climate projections are, however, in agreement as to increasing climate variability affecting Burkina Faso – the shorter and more unpredictable

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1 This PRISE study has not carried out any new research on evolution of the climate in Burkina Faso, relying instead on existing sources, including by other papers produced for the PRISE project (Wetta et al, 2015).
2 It would be useful for a further phase of study to add information, to the extent it is available, on the number of rainy days and the intensity of rainfall.
3 Distinguishing variations in rainfall due to climate change from natural variations is difficult.
4 Accordingly, in the present report, the focus is on climate variability rather than (human-induced) climate change.
rainy seasons noted above, with the likelihood of increasing pressure on water resources. The AGRHYMET (Agriculture, Hydrology, Meteorology) Regional Centre recalls6 (page 20) the ‘persistent drought in the Sahel’ in the 1970s and 1980s, with after 1993 another mode of variability which seems to have developed within the Sahelian rainfall of ‘a strong alternation between very wet years and very dry years’ across the entire region. This new mode of variability, AGRHYMET notes, makes it ‘even more difficult to make inter-annual predictions’. The authors of the AGRHYMET report continue: ‘It does not seem appropriate to express the current rainfall regime in the Sahel in terms of end of drought or not the end of drought, as there is no single trend. That said, the tendency to drought continues in the Western Sahel (Senegal and western Mali), while the East (Chad, eastern Niger) is experiencing gradual return to wetter conditions’. As to which situation prevails in the central zone where Burkina Faso is located, the sources are inconclusive. Some climate projections forecast higher, and some lower, rainfall.

This uncertainty is echoed by Lacombe, McCartney and Forkuor (Lacombe et al, 2012) who refer to ‘an abrupt decline in annual rainfall in areas north of latitude 11°N’ (i.e. just south of the Burkina Faso-Ghana border) ‘since the 1970s, with uncertainty as to whether or not rainfall has recovered in more recent years’ (the authors cite L’Hôte et al. 2002, Ozer et al. 2003, and Nicholson 2005).

Within the semi-arid central region of Burkina Faso, the area of study is that around the Ziga dam located 50 km to the north-east of the capital city of Burkina Faso, Ouagadougou, on the Nakambé River (the ‘White Volta’) in the province of Oubritenga. The Nakambé, shared with neighbouring Ghana, is one of four principal rivers of Burkina Faso along with the Mouhoun (or ‘Black Volta’, also flowing into Ghana), the Comoé and the Volta’. The Nakambé, shared with Ghana, is one of four principal rivers of Burkina Faso along with the Mouhoun (or ‘Black Volta’, also flowing into Ghana), the Comoé and the Niger tributaries.7

The water in the reservoir of the Ziga dam is reserved for use by the National Office for Water and Sanitation (ONEA), the water company serving urban centres in Burkina Faso (settlements with more than 3,500 inhabitants). With it, ONEA supplies Ouagadougou with most of its water supply - 70% (GoB, 2013). Both Ziga and Ouagadougou are located in the central semi-arid plateau of Burkina Faso. The total volume of the Ziga reservoir when full is 200 million cubic metres, with a ‘useful volume’ according to ONEA of 184.7 million cubic metres (useful volume is also sometimes referred to as ‘live’ or ‘active’ storage).9

In the period from 1985 to 2000, the population of Ouagadougou doubled from 436,000 to 980,000 inhabitants, putting intense pressure on water production and distribution capacity (Wetta and Fofana, 2010). From the 1980s onwards, there were more and more frequent service interruptions, with major problems in provision of water for the residents in the new peri-urban areas, including slums, which grew up around the city centre. Ouagadougou’s population in 2006, according to the census, was 1,475,839, comprising 85% of the population of the Central region (INSD, 2011), increasing to 1,844,000 in 2012 (source: Guengant, 2011). The experience of the ten years from 1996-2006 was of more than half of urban population growth occurring in Ouagadougou/the Central region (53.1%), alongside 14.2% in Bobo-Dioulasso (GoB, 2008, p.19).

The Ziga-Ouagadougou pipeline is a major rural-to-urban water transfer. It was the subject of the preliminary study conducted by PRISE in November 2014. The report of that 2014 study points to experiences of water transfers in other countries and discusses the issues at the ‘urban-rural interface’ including the economics and politics of transfers of bulk water from rural to urban areas.

The 2014 study suggested that young people are leaving the Ziga area to look for work elsewhere. The present research investigates the extent of migration from the villages and the factors influencing the decisions to migrate, including the reasons which relate to agriculture, water and climate.

In many places in Burkina Faso, watercourses are ephemeral. An important natural feature, however, is low-lying places (les bas fonds in French), namely dips in the terrain where water collects in the rainy season, serving as water sources for at least part of the dry season (Alberger et al, 1993). Volumes of water collected can be increased by construction of dams, whether smaller dams at these low-lying places to capture rainfall, or large dams to impound river flows.


7 AGRHYMET comments that: ‘the climate divides between the East and West also expresses an increase in spatial variability of rainfall. It renders ineffective the vision of a generally wet or dry Sahel’.

8 Les bas fonds (‘Red Volta’) basin is a sub-basin of the Nakambé.

9 ‘Useful’ volume = total volume minus the ‘dead’ volume at the bottom of a reservoir below the level of the outflow point, which cannot be withdrawn. The useful volume is the portion above this level which can be removed by gravity. Sedimentation may reduce the useful volume. Dam managers will also need to take into account the safety of operation. Depending on the primary purpose of a given dam, enough volume of water will be required for irrigation, or urban water supply, or enough “head” of water for energy generation.

As discussed in the report of the 2014 study, water storage in small reservoirs/ponds in low-lying areas using natural materials is an example of ‘natural infrastructure’ alongside the civil engineering of large projects such as the Ziga dam.\textsuperscript{11} These small dams/ponds can be built as ‘low-tech’ and relatively low-cost structures comprising a large natural element, earth. The ‘WISE-UP to Climate’ project, led by the International Union for Conservation of Nature (IUCN), aims to show how mixed portfolios of built and natural infrastructure can be a ‘nature-based solution’ for climate change adaptation and sustainable development.\textsuperscript{12} The PRISE project, meanwhile, recognises the contribution natural capital can make, alongside human capital, to economic growth and social development.

In Burkina Faso, since 2015 the term ‘small dam’, according to the definition of the National Dams Committee (le Comité National des Barrages du Burkina) (source: CNBB, 2015), refers to dams of between 2 and 5 metres in height (from the crest of the dam to the lowest point of the natural terrain), with also a volume of water storage of less than 5,000,000 m\textsuperscript{3}. Below that height, another term should be employed such as ‘pond’ (retenue d’eau). In the study carried out by the International Water Management Institute-IWMI, described in Section 1.5, the small dams (according to the term used by IWMI in 2014) in Burkina (and Mali) were lower in height (< 1 metre), i.e. strictly, therefore, (since 2015) ponds (‘retenues d’eau’). As for the depth of reservoirs in Burkina Faso, in a country with a generally flat terrain, most reservoirs are shallow with a tendency to be wide/long, with also substantial seasonal variations.

The National Plan for Economic and Social Development 2016-2020 - the ‘PNDES’ by its acronym in French - notes the vulnerability of agriculture in Burkina Faso to ‘unstable’ rainy seasons and ‘severe’ dry seasons (PNDES, page 84) and sets out an ambition to increase the contribution of irrigated agriculture to overall national agricultural production from 15% in 2015 to 25% in 2020 (PNDES, page 66). This is discussed in Section 3 of this report.

The goal of water management in Burkina Faso, as stated in Article 1 of the 2001 Water Policy Management Act, is to ‘satisfy or reconcile the demands of agriculture, livestock, fishing and aquaculture, extraction of minerals, industry, energy production, transport, tourism, leisure and all other legally-exercised human activities’ as well as ‘water quality’ and ‘protection of aquatic ecosystems’ (GoB, 2001). The government, through the Ministry of Water (Ministère de l’Eau, des Aménagements hydrauliques et de l’Assainissement) (MAHRH) is responsible for overseeing how these different demands are to be satisfied as far as possible, to the extent they are complementary, or how they are to be reconciled, where competing.

Both urban and rural populations in Burkina Faso of course require water for drinking/domestic and productive uses. Under Burkina Faso law, drinking water use is highest in the hierarchy – the first listed in Article 1 of the 2001 Act (GoB, 2001). The 1998 National Water Policy adds that the objective is to ‘satisfy sustainably, in quantity and quality, the water needs of a growing population and an economy in development’.\textsuperscript{13} To achieve this objective, ‘integrated’ water resources management\textsuperscript{14} (IWRM - ‘GIRE’ in French) is noted (GoB, 2003) as being the ‘foundation’ of the national water strategy. The separate report published by PRISE (Wetta et al, 2017) reviews the progress to-date, and the gaps, in implementation of IWRM in Burkina Faso.

The PNDES notes that poverty is essentially rural in Burkina Faso, with an incidence of 47.5% compared with 13.6% in urban environments. Reduction of poverty between 2009 and 2014 was more dynamic in urban environments compared to rural (PNDES, page 23). The incidence of poverty is higher in the following regions: the Centre-South (40.5%), the South-West (41.5%), the Plateau Central (45.4%), the Centre-North (47%), the East (49.6%), the Centre-West (51.7%), the Boucle du Mouhoun (59.7%) and the North (70.4%) (PNDES, page 23) (emphasis added). Food insecurity in the Plateau Central was reported in 2012 as being the highest in Burkina Faso, affecting 43% of households, compared with 36% of households in the Centre-South, 33% in the Centre-West, 28% in the Centre and 26% in the Centre-North\textsuperscript{15} (FEWS NET and WFP, 2014, page 78).

\subsection*{1.2 Focus of study}

Eight villages in the area around the Ziga dam and reservoir were selected for this study, as marked in red circles on the map in Figure 2 - the sites of the survey (noted in French on the map as the sites d’enquête).

As shown in Figure 2, the eight villages are located in different positions around the reservoir - from Bissiga on the west side of the lake in the north, via Beta and Ziga in the centre-west, to Gondogo, Nagréongo Koudogo

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\footnotesize
11 Newborne and Tucker 2015, Section 2.5.
12 https://www.iucn.org/theme/water/our-work/wise-climate
13 The Act specifies that ‘in relation to access for water for drinking, the different categories of population must be treated equitably’ (GoB, 1998).
14 In French, gestion intégrée des ressources en eau (GIRE), hence the title of the national integrated water resources management (IWRM) plan in French: the PAGIRE.
15 According to the FEWS NET and WFP, 2014 report, ‘the households in the (northern) Sahel region, while more vulnerable in economic terms, have better food consumption because they consume milk and milk products more frequently…’ (page 78).
\end{flushleft}
Figure 2: The villages surveyed in the Ziga area

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In terms of available services, the villages also reflect different situations, as shown in Table 1. Only two villages out of the eight (Bissiga and Nagréongo Koudogo) have good road access. Elsewhere, the rutted and (in places) eroded, dirt roads become mud traps in the rainy season, including sections that flood in low-lying areas. That combines with the lack of electricity and health facilities in, respectively, six and three villages to make the villagers feel isolated - the phenomenon of ‘enclavement’ in French – especially when flood waters block access. When that happens, the people of Absouya, for example, cannot go by the usual southern route to Ziniaré, but instead have to travel the long way around via Korsimoro to the north (the district of Korsimoro is shown on the map in Figure 2, although the town of that name is located beyond the northern limit of the map). As for status of water supply in the villages, this is considered in Section 2.1.

The key issues on which this study has focused are as follows:

• **Agriculture and water:** How are farmers in the zone managing in the face of water challenges? Do they have access to water for irrigation, and in particular for the growing of vegetables and fruit through market gardening (maraîchage in French)? How viable or otherwise is their agriculture? What are the perspectives for the future of farming, as perceived by the persons questioned? Overall, are the persons questioned (i) optimistic or (ii) pessimistic for their farming over the coming five coming years? (the type of farming is described in Section 2 of this report).

• **Climate:** Have the surveyed households been affected by drought, flood or other natural phenomenon? If so, when, and of what severity? What are the factors that could affect their farming activities this year 2017? Given the climatic conditions that the respondents are experiencing, when asked again about the perspectives for their agriculture over the coming five years, are they (i) optimistic or (ii) pessimistic?

• **Migration:** How many of the households questioned have a family member who has migrated away from the locality? Who has migrated and for what reasons(s)/due to what factors, including among other things lack of access to water for irrigation? What is the destination of the migrants - are they going to rural areas or urban areas (e.g. the capital, Ouagadougou)? Is the migration permanent or seasonal? What kinds of situation do the migrants find themselves in at their destinations? What do they send/bring back to their villages in remittances/returns? What is the effect, overall, of this migration on life in the villages?

### 1.3 Methodology

The research team for this study comprised researchers in Burkina Faso and a researcher based in the UK (the author of this report). Four enumerators conducted a quantitative survey of households in the selected villages using a detailed questionnaire. The questions set out in the questionnaire in relation to each of the three principal components of the study - agriculture and water, climate, and migration - are noted in the Annex to this report.

In six of the eight villages, 25 persons were interviewed in each village with a few more in two villages (Nioniogo and Ziga), making a total of 207 households surveyed.

In accordance with the design of the survey, most of the households are located in villages upstream of the Ziga dam, with a little more than 1/3 (36%) downstream.

The persons interviewed were mostly men, with just 17 women, of whom nine are married and eight are widows.

Within each village, the households surveyed were selected at random by the researchers who used their motorbikes to go to different parts of the villages, to identify houses in various locations. Village representatives (representatives of the village development committees - les comités villageois de développement) and other village members supported the process.

In parallel, in four out of the eight villages, Bissiga, Ziga, Absouya and Kolkom, focus group discussions were carried out - a total of eight. Those four villages are located to the west and east of the Ziga reservoir, and both upstream and downstream of the dam. They represent different levels of services, as per Table 1. The focus
group discussions were segregated by gender, with men and women meeting separately.\textsuperscript{18}

The field research was carried out from February 8th – 12th, 2017, after preparatory reconnaissance visits in January 2017 and a preliminary test of the questionnaire in early February 2017.

### Table 1: The villages surveyed – geographical position and services (other than water supply)

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Special status</th>
<th>Road access</th>
<th>Electricity</th>
<th>School</th>
<th>Health centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bissiga</td>
<td>Upstream - north-west (located close to the Ziga reservoir between a bend in the river)</td>
<td>No</td>
<td>Good - borders a main (tarmac) road</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Beta</td>
<td>Upstream - north-west</td>
<td>No</td>
<td>Poor – long dirt road to/from village which is flooded in the rainy season with the village sometimes cut off by water from east and west</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Nioniogo</td>
<td>Upstream – centre</td>
<td>No</td>
<td>Poor - long detour around the Ziga reservoir via dirt road (often flooded in rainy season)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Ziga</td>
<td>Upstream – centre</td>
<td>Centre of traditional chiefdom</td>
<td>Poor – long dirt road to/from Ziniaré (difficult in rainy season)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Absouya</td>
<td>Upstream - east</td>
<td>Head village of the district (commune)</td>
<td>Poor - after crossing the road bridge on the Ziga dam, there is long dirt road (often flooded in rainy season). The route is a detour around the dam lake</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Nagréongo</td>
<td>Downstream – centre</td>
<td>No</td>
<td>Good – close to the tarmac road which leads to the Ziga dam itself</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Koudogo</td>
<td>Downstream – south-west</td>
<td>No</td>
<td>Poor – long dirt road to/from village which is flooded in the rainy season and the village is cut off by water from east and west</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Kolkom</td>
<td>Downstream – south-west (the southern-most location)</td>
<td>No</td>
<td>Poor - long dirt road, often flooded in rainy season. The children have to walk 12 kms to school at Gondogo</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: Authors.

### 1.4 The Ziga project – phase 1

Given the area of study is the zone around the Ziga dam and reservoir, this section and Section 1.7 provide a brief account of the conception and construction of the Ziga project.

From the 1940s/50s, Ouagadougou’s principal water sources had been the No. 2 and No. 3 dams, with a maximum combined capacity of 5.5 million m\textsuperscript{3} and the Loumbila dam, built in 1947 and extended in 1970, adding a further 40 million m\textsuperscript{3} (ONEA, 2013). The growth in size of the city and the lack of sufficient bulk water supply to meet its water demand in the 1980s gave rise to the project to construct the Ziga dam\textsuperscript{19} and to lay a water main (1 m in diameter) from there to Ouagadougou for conveyance to the capital of 4,500m\textsuperscript{3} of water per hour, i.e. c.40 million m\textsuperscript{3} per year.\textsuperscript{20}


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\textsuperscript{18} The focus groups were well attended, with in most cases between 10 and 20 participants, less in the case of the women’s group in Bissiga (8), more in the case of the women’s group in Kolkom (over 30).

\textsuperscript{19} The dam is 16.8 m high and the embankment is a little over three km long, with a spillway 120 m wide (ONEA, 2013).

\textsuperscript{20} Source: key informant interview in November 2014.
The Ziga reservoir flooded the bottom of the Nakambé river valley over an area of 8,000 hectares (when full). In so doing, it displaced around 8,500 persons in 17 villages (ONEA, 2013). Villages like Absouya, Ziga and Bissiga lost some of their most fertile lands under the reservoir thereby increasing the pressure on land and displacing village members onto areas of poorer soils.

The provision of this new water source served to relieve Ouagadougou's chronic bulk water supply shortages of the 1990s and enabled ONEA, as the urban water utility, to extend the distribution networks and water services within the city. Piped connections (taps in individual houses or to yards) are what ONEA aims to provide in the larger towns. In the villages and small towns that are the responsibility of the Directorate-General for Water Resources (DGRE), the infrastructure for drinking and domestic water consists, typically, of communal water points (boreholes), without household connections.

As for the operation of the Ziga dam, a key feature has been that the communities upstream of the dam are prohibited from access to the water in the Ziga reservoir. The use of the Ziga reservoir for irrigation, including small irrigation or market gardening (maraîchage), is (as stated in the April 2013 workshop led by the MAHRH on behalf of the government - GoB, 2013) ‘totally incompatible’ with the lake’s drinking water purpose because irrigation would pollute the lake with chemicals from fertilisers and pesticides making the water prohibitively expensive for ONEA to treat.

The 2014 study recorded that the people in the Ziga area acknowledged the need for drinking water to be supplied to Ouagadougou and understood the need to protect the Ziga reservoir from pollution.21

The considerable local resentment that was observed in 2014 arose for another reason, namely the lack of sufficient alternative irrigation options. The construction of the dam was supposed to have been accompanied by mitigation and compensation measures, namely: ‘three small dams for water storage and irrigation of 71 hectares at Absouya and Gaskaye, and renovation of a small dam at Nagréongo’; as well as ‘15 grain mills’, a ‘forest management plan including re-planting of 185 hectares’, plus ‘21 boreholes’ for access to water in villages; also ‘95 kms of country roads’ (according to ONEA, 2013).

Local leaders in the villages, however, stated to the 2014 study that the government had not honoured its commitment to build the small dams as promised. The small dams - key informants reported in November 2014 – had either not been built, or at least not well built; one dam had been constructed but had collapsed as the earthwork was not strong enough. Local people felt compensation for construction of the Ziga dam had not been adequate and government was not engaging with local stakeholders in a spirit of ‘give and take’.22 The combined effect of the ban and insufficiency of alternative options was (the 2014 study was told) to substantially reduce the occurrence of irrigated agriculture in the area, thereby depriving farmers of a means to generate income.

It was especially young people of the communities who expressed to the researchers in 2014 frustration that they could not make a better living by producing vegetables and other products of irrigation for subsistence and, in situations where there is available market access, by selling them. The 2014 study heard how young community members were migrating away and, among those remaining, there was a grumbling discontent. Hence, the interest of the present survey to ascertain the extent and nature of migration.

Based on the preliminary study conducted by PRISE in November 2014, it is clear that there are some opportunities for irrigation downstream of the Ziga dam. The report of that study gives23 the example of a group of around 200 women who are benefiting from irrigation of an area of around 8 ha located some 800m downstream, alongside two other groups. The water they are drawing comes out of the river channel below the dam, which means it is not competing (at least not directly, depending on spills/releases of water from the Ziga dam) with the water extracted from the reservoir for the treatment plant and conveyance to Ouagadougou.

1.5 Small dams/ponds for water storage and irrigation

As discussed in a report of the International Water Management Institute-IWMI (Keller, Sakthivadivel and Seckler, 2000), the following are ways of storing water: (i) in the soil; (ii) in underground aquifers; (iii) in small reservoirs behind small dams; and (iv) in large reservoirs behind large dams. The authors note that storage in the soil is extremely important for crop production, while providing relatively short-term storage, often only sufficient for a period of days. For the longer-term, small reservoirs can store water for periods of months, compared with aquifers and large reservoirs for longer - years.

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21 As noted in the 2015 report of the preliminary study, the villages around the Ziga reservoir (both sides of the lake) contribute members of the ‘Union for the Protection of the Banks’ for surveillance of the shores of the lake.
22 Section 3.2 of the report of the 2014 study (Newborne and Tucker, 2015).
For politicians and policy-makers responsible for overseeing development of national capacity for water storage matching supply to demand, the authors underline the importance of a combination of small and larger reservoirs, alongside aquifers. All three options serve an indispensable role in water storage with each technology offering ‘strong comparative advantages under specific conditions of time and space’. Where it is possible to do so, ‘substantial gains can be achieved by combining all three storage technologies in an integrated system.’ Systems that comprise a mix of complementary storage options are more likely to be more adaptable and acceptable than those based on a single storage type’ (McCartney and Smakhtin, 2010).

As for small reservoirs, one of the principal comparative advantages is that they can be sited (very) close to their points of use with, as a consequence, good responsiveness to local demands. Small reservoirs, however, experience high rates of evaporation loss compared with those from large reservoirs due to the generally greater depths of water in the latter (less surface area per volume). Further, small reservoirs allow storage for periods of months only as compared with years in the case of large reservoirs (i.e. no inter-annual carry-over). To be built safely and securely, small reservoirs need to incorporate means of evacuating storm waters at moments of very heavy rainfall – i.e. properly constructed spillways in addition to careful construction of embankments (well-compacted soil to avoid holes which become ‘pipes’ that breach the dam from within). Meanwhile, in both small and large reservoirs, sedimentation reduces storage capacity. Small reservoirs can provide water for a range of uses - for irrigation, watering of animals and aquaculture. As for water seeping and percolating into the ground, it is a ‘loss’ to surface water storage reservoirs, but can thereafter be a gain in terms of water extracted from the ground via boreholes or wells – i.e. reservoirs can perform a groundwater recharge function.

Experiences of small dams/ponds located in low-lying areas in Burkina Faso (and Mali), aimed at improving the reliability and availability of water for irrigation, have been analysed and documented by Katic, Lautze and Namara, 2014. The authors selected four sites in the south-west of Burkina Faso supported by the ‘Programme pour l’Aménagement de Bas Fonds dans le Sud-Ouest’ (PABSO) including with donor funding. The PABSO project was comprised of three components: (i) construction of small-scale water infrastructure (ii) complementary measures such as support to farmer organisations, training on marketing and conservation, and strengthening capacity in the areas of land titling and infrastructure maintenance, (iii) facilitating rural credit.

The authors of the 2014 study note that the four sites in Burkina Faso are located in the semi-arid zone, where rainfall is overwhelmingly concentrated in a few months of the year (Katic et al, 2014), like in the area around the Ziga dam/reservoir, although in the four PABSO sites in Burkina Faso analysed by Katic et al the average annual rainfall figures are somewhat above the 900 mm level of the ‘soudano-sahelian’ conditions of the central zone pointing, the authors say, to a slightly ‘wetter soudano-sahelian’ climate (Katic et al, 2014).

The authors used cost-benefit analysis to assess the impacts in these four sites of small built water storage infrastructure on agricultural production. The aim was to find out whether the investment in construction and yearly maintenance and operational costs of the irrigation scheme is justified in terms of a higher agricultural production and agricultural incomes. The answer was positive. As described in Box 1, in the sites examined by the study, the construction of small built infrastructure (meaning here a dam wall of less than 1 metre high) increased the quantity, duration and reliability of water available to farmers. Surface water availability was prolonged in the main season and groundwater availability increased in the offseason. This allowed farmers to substantially augment economic benefits derived from agricultural activities (Katic et al, 2014, page 92).

The key finding of the 2014 study as set out in Box 1, namely that built infrastructure in bas fonds augments the agricultural production, is consistent with other studies in other countries in West Africa. The authors (Katic et al, 2014) conclude that the results call for more investment in small-scale built infrastructure in the bas fonds of Burkina Faso (and Mali) where local conditions are suitable, for example in terms of humidity/dryness (Albergeal et al, 1993 and FAO, 2015). That investment, the authors note, needs to be accompanied by measures such as support to farmer organisations (Sanou et al, 2013), training on marketing and strengthening capacity in infrastructure maintenance.

24 As noted in Section 1.1, these small dams can be of modest size, for example c.1 metre in height, as in the case of the ponds (retenues d’eau) in Burkina Faso (and Mali) described in Box 1.
25 The four sites were selected at random by the authors from a total of 45 PABSO sites (Katic et al, 2014).
26 From the German cooperation agency, KFW.
27 Mougué: 971 mm per year; Naberé: 976 mm per year; Dadoné: 976 mm per year; Kombazien: 936 mm per year (source: Katic et al, 2014).
29 Low rainfall was reported by farmers as being a significant constraint to achievement of expected levels of production (of rice) at the three bas fonds sites located in the North region of Burkina Faso evaluated by the FAO where rainfall is typically lower than in the central soudano-sahelian zone of the country.
**Box 1: Benefits of small built water storage infrastructure for agriculture in Burkina Faso**

**Interviews** were conducted with 25 farmers (13 men, 12 women) across the four sites in Burkina Faso: Mougué, Naberé, Dadoné and Kombazien, in the Black Volta basin.

**Water infrastructure**: the nature of water infrastructure at the sites was a terraced system of small dams (here, <1 metre in height) nested along the beds of ephemeral (seasonal) streams. Each site also possessed several manually operated gates to enable water to be channelled through the system as needed.

**Irrigated area and number of farmers**: the irrigated areas before and after the project (main season) and the number of farmers was as follows: Mougué: 20 ha – 25.6 ha (112 farmers); Naberé: 7 ha – 35 ha (76 farmers); Dadoné: 15 ha – 26.3 ha (109 farmers); Kombazien: 22 ha – 40.5 ha (316 farmers).

**Road access (e.g. for accessibility of markets)**: the sites vary in distance to major roads: Mougué: 6.7 km; Naberé: 13.8 km; Dadoné 4.4 km; Kombazien: 6.9 km.

**Crops**: rice (Naberé, Mougué et Kombazien); rice, onion and cabbage (Dadone).

**Yields**: comparison of overall production **before** versus **after** the PABSO projects shows that main season yields - of rice - nearly doubled).

**Benefits**: this allowed farmers to substantially augment economic benefits derived from agricultural activities.

**Farmers’ organisations**: the farmers’ organisations/cooperatives in charge of managing and maintaining the infrastructure appeared to have generally increased their benefits, earning incremental profits from increased yield, while providing labour for the construction of the infrastructure, and receiving back fees from farmers for its use.

**Institutional sustainability**: differences in the strength of organisations at different sites were noted. The authors underline the importance for the institutional sustainability of the infrastructure interventions of farmers’ commitment. A relevant indicator of this commitment may be the rate of paid (or unpaid) farmers’ fees.

*Source: Katic et al (2014).*

In the four cases in Burkina Faso described in Box 1, the production of rice is essentially limited to the main growing season, except at one site (Dadone) where the farmers additionally grow onions and cabbages in the dry season.

The practice of dry season agriculture would be an aim of the communities in the area around Ziga - were irrigation to be available to them through construction of small dams – in order to grow fruit and vegetables via market gardening (called *le maraîchage* in French) from October/November onwards. The length of time such small reservoirs/ponds could retain water would vary according to local conditions, depending on the type of soil and the degree of evaporation, as well as the size of the reservoir/pond and the pace of water extraction for irrigation. In the Ziga area after the end of the rainy season in October, small reservoirs/ponds are capable of retaining water for 4/5 months, until February.

The fruit and vegetable sector emerged as a significant contributor to agriculture in Burkina Faso in the 1990s (Retailleau, 1994). According to the study carried out in 2007 with the participation of the Ministry of Agriculture, Water and Fisheries as well as representatives of the Regional Chambers of Agriculture and Small Farmers’ Organisations, the sector employed more than 400,000 people including 100,000 women. The production of fruit and vegetables represented in 2002 16.5% of agricultural production (EASYPol, 2007).

For the Ziga communities who do not have access to a town market via a good road (that applies to six out of eight villages surveyed), *le maraîchage* is likely to be seen as a means of consuming fruit and vegetables at little cost more than a source of income. In other words, much of the production would be for subsistence for the benefit of the households themselves (or for gift to other households), with the surplus being sold at local village markets. The irrigated areas may typically be small (e.g. less than 100 m2). The production cycle will typically be short, from October/November to February/March.

### 1.6 Health and environmental issues arising

The report of another study in Burkina Faso carried out by the International Water Management Institute-IWMI has focused on the health and environmental implications of small dams/reservoirs (Boelee et al 2009). The authors note, first, that positive health impacts can arise from the presence of small dams/reservoirs, through access to better nutrition and the opportunity to increase household incomes (e.g. to pay for medication). Secondly, they describe the risks of adverse health impacts, and the measures that can be taken to reduce those risks.

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30 Boelee et al 2009 note that few studies have been done, to-date, on the nutritional impacts of small reservoirs.
The authors cite field studies that found increased transmission of schistosomiasis (bilharzia) as a result of the presence of snails in/around small water bodies, both natural seasonal ponds (common in Burkina Faso) and artificial reservoirs. The transmission of schistosomiasis takes place through water contact either during domestic activities, such as laundry or bathing, or productive activities, e.g. irrigation and fishing (Boelee et al 2009, page 2). Where soap is used, bathing is safer, because most soaps are toxic to the larvae, with the soap remaining effective in the water for a while after the bath. That can be combined with reduction of the risks of contamination by measures such as removal of vegetation from popular water use points to reduce the presence of snails (Boelee et al, 2009, page 25). In the words of the authors, as a determinant of transmission: ‘human behaviour regarding water use and hygiene … is more important than the presence of snails’ (Boelee et al 2009, page ix).

In relation to malaria, the situation is – the authors say - more complicated. The increase in mosquito-vector density caused by the presence of a small reservoir and irrigated area is ‘a real risk’, although ‘the actual incidence of malaria will vary according to the climatic zone and local socioeconomic circumstances’ (Boelee et al 2009, page 18). ‘Mosquitoes do not tend to breed in the reservoir itself and an increase in vector mosquitoes does not necessarily lead to increased malaria prevalence’ (Boelee et al 2009, page ix).

The authors point to the need for adequate sanitation, including construction and effective use of sanitary facilities to manage human waste (latrines), combined with health education including encouragement to people to relieve themselves in a safe place before they enter the water.

The authors recommend that community groups (water user associations, farmer groups, women’s group etc.), organise action to take the above preventive measures, with help also much needed from government agencies and NGOs in supporting improvements to environmental health.

1.7 The Ziga project – phase 2

At the time of construction of the Ziga dam, it was noted that, given the likelihood of further growth in population, the sufficiency of bulk water supply to Ouagadougou in the medium term would need to be monitored. A decade later, in 2013, the city hosted nearly 2 million residents out of a total population in Burkina Faso of 17.3 million – that is, 8-9% of the total national population (according to the projections of the National Demographic and Statistics Institute - INSD) putting a strain again on the city’s water supply. In 2014, water shortages in Ouagadougou caused occasional cuts to supply. Although these cuts were not regular, they indicated that the level of bulk water demand in Ouagadougou had grown with the risk that the capital would return to the situation of chronic shortages in the 1990s.

By way of response, a second phase of the Ziga project is being constructed comprising a second mains pipe, additional to and parallel with the existing mains pipe – at 1.2 m in diameter bigger than the existing Ziga-Ouagadougou main of 1 m diameter, as well as increased water treatment capacity at the Ziga dam. ONEA reports that the capacity of the treatment plant will increase from 4,500 to 9,000 m3 per hour and the second main will more than double the 40 million m3 that can be conveyed to the capital. Based on these ONEA figures, a conveyance capacity of Ziga Phase 1 and 2 combined can be extrapolated to approximately 100 million m3 per year. This would leave, based on the figure for the Ziga reservoir, when full, of 200 million m3, a margin of 80 million m3 for future capacity growth. The crest of the Ziga dam does not have to be raised as part of Ziga Phase 2.

The cost of Ziga Phase 2 is to be FCFA 105 billion, equivalent to approximately Euros 158.5 million. Funding support is being made available by external donors, including the French Development Agency-AFD, the World Bank, the European Investment Bank (EIB) and the Islamic Development Bank.

The construction works for Ziga Phase 2 including the enlarged water treatment plant at the Ziga reservoir are due to be completed in June 2017.

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31 According to INSD’s projection for 2013 (‘key indicators’ on INSD’s website).
32 At the time of carrying out this study, the construction works were clearly visible at places beside the road from Ziga to Ouagadougou, including at the water treatment plant near the Ziga dam.
33 As noted in Section 1.4, the water supply for Ouagadougou provided by Ziga Phase 1 did not take the extraction of water from the Ziga reservoir to its full capacity.
34 Source: key informant interview in November 2014.
35 A subsequent phase of research could usefully verify this figure.
36 As discussed in the report of the 2014 study (Newborne and Tucker, 2015 – Section 2.1), the population of Ouagadougou is still increasing at a fast rate, higher than the rate of national population growth of 3%.
37 Source: http://news.aouaga.com/h/84801.html
38 Source: AFD website: http://www.afd.fr/home/pays/afrique/geo-afr/burkina-faso/ctnscroll_ActualitesList/6_12
2. Results of the study

‘Sometimes we have good rains, but often now they are either very heavy or very light, either drowning crops or drizzling at them, or stopping altogether, without providing enough moisture to grow well’ (source: the women’s group at Absouya village).

‘From a small cultivated area, we used to be able to obtain a good yield; now you need to apply fertiliser and it is difficult to find parcels sufficiently big and productive’ (source: women’s group, Ziga village).

This section describes:

- the nature of agriculture in the surveyed villages;
- the climatic and other conditions which village members are experiencing;
- the levels of migration, and its drivers;
- the role and perspectives of women in the communities.

2.1 Agriculture and Water

For all but three out of the 207 households surveyed by this study, the principal activity is agriculture (livestock as well as cultivation of fields). Secondary activities practised (by a third of households) include various types of businesses, mostly carried out by women (as shown by the focus groups - examples are noted in Section 2.4), plus fishing, charcoal production and other trades by men (e.g. one carpenter and one mechanic were interviewed).

The persons responding to the survey were very largely (84%) the heads of households with some sons and a few wives and brothers of heads of household. Most respondents (89%) said they were long-standing residents (autochtones), with some ‘newcomers’ residing in the villages of Nagréongo Koudogo and Kolkom downstream of the Ziga dam (in the six other villages, all the respondents said they were long-standing residents, with just one ‘new’ arrival in Ziga village).

All but two of the 207 households surveyed possess land, mostly (70%) owned by the households themselves. The plots of land are mostly small: 72% of five hectares or less, and a further 18% of between 6 and 10 hectares (with 4% between 11 and 20 hectares and the rest over 20 hectares). As to what is produced on the land, it is the head of the household who decides (97%). The crops grown by the villages are, typically, millet, groundnuts, potatoes, sesame, sorghum and maize (source: focus groups). The land is mostly farmed for subsistence purposes with little or no production sold. A small proportion of households (11% of the total) said they sold a small part (less than 25%) of their production, in Bissiga, Beta, Nagréongo Koudogo and Kolkom.

The great majority of households surveyed (96%) have animals (cows and sheep/goats), although in modest numbers – on average 10 heads of cattle and 20 sheep or goats. According to the men’s focus group at Absouya, those are smaller herds than before the construction of the Ziga dam because of the lack of water and the reduced space – less available land – and an end to watering livestock in the river.

Men, women and children work in agriculture with the women more present in the fields at the time of the present study due to migration of young male family members (as to the calendar of migration, see Section 2.3).

The number of children recorded by the respondents to the present survey is on average 10 per household (according to the most recent national census in 2006, in rural Burkina Faso there is an average of 6.8

39 Based on the responses to the survey, 24 years (on average) of residence does not qualify a person as a long-standing resident.
40 http://www.insd.bf/n/contenu/Tableaux/TD305.htm The next census has not yet been carried out (due to start in 2016, but postponed).
children per family compared with 4.6 children per family in urban contexts). The high figure in the Ziga area is explained by the prevalence of polygamy. Among the respondents to the survey, there is an average of three wives per husband, across the eight villages. Participants in focus groups (e.g. in Bissiga village) referred to the growth in local population as an issue.

The agriculture in the area is predominantly rain-fed - water storage for irrigation is mostly unavailable. The prohibition on direct access to the Ziga reservoir for irrigation was confirmed by the survey and focus group discussions. A large majority (82%) of respondents said that none of their fields were irrigated, with just 17% reporting that some of their plots were irrigated. The principal sources of irrigation water are reported to be: from canals (25 households), e.g. the spillway at Nagnéngou Koudogo, or small dams (nine households) or low-lying areas where rain collects (les bas fonds) (four households). In the Ziga and Absouya villages, no households surveyed reported access to irrigation, with just a few in Bissiga. Most of the households with access to irrigation are in the villages downstream of the Ziga dam, e.g. in Nagnéngou Koudogo and Kolkom, though not all: a few (4%) of the families interviewed in locations upstream of the dam do have part of their lands irrigated. Even downstream, 23% of households surveyed have no irrigated land, e.g. none in Gondogo. In other words, the significance of positioning upstream or downstream of the dam in terms of access to water for irrigation is nuanced. Being downstream does not guarantee access to irrigation from the Ziga reservoir. It depends on the particular circumstances of access via canals or small dams. Similarly, upstream access to irrigation depends on the presence of a small dam. There are a few of those in the area, e.g. there is a small dam near Absouya and near Bissiga.

The 2014 study noted that local people understood the ban on irrigation on the shores of the Ziga lake and the participants in the focus groups conducted by the present study confirmed this. They accept the need to keep the reservoir free from polluting chemicals (pesticides and nitrates) so as to maintain the quality of the water for drinking. Local people, as represented in each of the focus groups, are, however, critical of the failure to provide sufficient alternative sources of irrigation – through small dams separate from the Ziga dam (source: focus groups).

The watering of animals is mostly (74%) done at boreholes despite these being intended primarily for drinking and domestic use by humans, compared with 20% at the few bas fonds while they retain water (e.g. near Bissiga village). At two villages near the Ziga reservoir, community members admit that they take the cattle to drink at the reservoir ‘from time to time’. They are not supposed to do that, because (they are told) of the pollution caused by the defecation of the animals, but, as one village member said: ‘If you tell me I can’t water my cattle as I used to and I have no alternative, what do you expect me to do?’ As shown by the results of the survey, herds of cattle in the area tend to be small.

Asked whether they were optimistic or pessimistic, overall, for their agricultural activities in the coming five years, strikingly 179 out of 206 respondents (86%) said they were pessimistic. This pervasive mood of concern is explained by other replies to the survey: 91% of the persons interviewed referred to a combination of irregular rainy seasons and the general lack of water for irrigation (92%) as major natural phenomena they are encountering.

The proportion of men who expressed this pessimism was 86% (of the men replying to this question) while all (100%) of the female respondents to the questionnaire said they felt pessimistic.

When asked if their agriculture was viable (rentable) most of the farmers said it was. That tends to contradict what was said in the focus groups, namely that it does not meet their food needs. The manner of formulation of the question is certainly open to different interpretations - and the question was largely inappropriate to this subsistence farming context. The respondents to the survey were, it seems, reflecting the view expressed in the focus groups that, with appropriate means, their agriculture could be viable, especially with more humid conditions.
and fertile soils as in the past. The communities are using techniques such as stone bunds (cordons pierreux) and zaï\(^{47}\) to capture humidity in the soil (source: focus group discussions), but these are labour intensive, and labour is, as noted above, a limited commodity in the communities of the Ziga area.

Where irrigation is available, the situation changes. For example, during the research for the present study, the inhabitants of Absouya informed the researchers that the water in the small dam/reservoir at Nabdoguem (a village located a few kilometres from Absouya) was drying up, in February. The water captured by this small dam had, in other words, lasted for 4-5 months, from October to February.

Since Kolkom is located downstream of the Ziga dam, the reservoir did not flood its lands, but the fields of Kolkom village are now less naturally productive because of the lack of river flow during most of the year. A branch of the river Nakambé used to run through Kolkom village territory serving as the source of water for irrigation, allowing for vegetable gardening (maraîchage). Now, with the Ziga dam holding up the river flow - except where water is released or spilled (when the reservoir is full) - the focus groups said - the soils are dryer and (natural) fertiliser (manure) has to be applied to produce a reasonable yield. The focus group in Kolkom noted that, when the Ziga reservoir becomes full during the rainy season (from September/October), ONEA opens the release gates of the dam, but from October onwards, no water is released down the river channel despite requests from the downstream villages. The reason for this was not expressed to the present study. The size of the storage capacity of the reservoir is such that other releases would be possible at some times (when the reservoir is well filled), were this made a principle of operation of the dam. Without, however, such an operating protocol, ONEA will naturally tend to be conservative in releases so as to be doubly sure of being blameless for any shortfalls in water supply to the capital city. The level of the Ziga reservoir will naturally drop as the dry season progresses, but, even with the combined conveyance capacity of both Ziga Phase 1 and 2, extrapolated at approximately 100 million m\(^3\) per year,\(^{48}\) this should leave, based on the figure for the Ziga reservoir when full, of 200 million m\(^3\) with a ‘useful volume’ according to ONEA of 184.7 million m\(^3\), a margin of 80 million m\(^3\) for making releases at appropriate times.

The pressure on the land is illustrated by the reduction in the trees and vegetation, meaning there is less available firewood (source: focus group in Absouya). Key informants to the 2014 study had told of the wooded area near Ziga (between the dam and Ziniaré) which had been listed as a protected forest some 40 years before, but which is now in a degraded state. Meanwhile, the men’s focus group in Bissiga as interviewed by the present study reported damage to crops due to trampling by cattle.\(^{49}\)

Kolkom and Bissiga village members used to fish in the river, using basic techniques, but cannot now do so because the river no longer flows downstream from the dam, except at short irregular times. That means they

\(^{47}\) The use in Burkina Faso of stone bunds (cordons pierreux) and zaï to provide plant nutrients - as well as other cultivation techniques have been the focus of a previous study conducted by PRISE. The report of the study (Dipama, 2016) points out their effectiveness as a means of increasing soil fertility and thereby agricultural production, while noting that that their application requires considerable investment in time and labour by farmers (Dipama, 2016, page 29 and 34) as well as technical support to those farmers from experts employed by public authorities.

\(^{48}\) These figures could usefully be verified by ONEA.

\(^{49}\) The cropping was on formerly classified forest land which was declassified and re-allocated to Bissiga village as replacement of land lost to the Ziga reservoir. This did not work, however, because of trampling by cattle, despite an effort by the Bissiga villagers to fence off the new cultivated fields. Those have now been abandoned.
50 There are norms for fishing on Ziga Lake – namely, fishing nets of a prescribed minimum mesh (35 mm), no artificial techniques for frightening the fish into the nets and no fishing very close to the dam (within 5 m) for safety reasons and to avoid snagging of the release gates. Apart from these, people are free to fish, day and night. In other words, the fishing is regulated, but not banned, as a use that is compatible with the primary use of drinking water supply, including at different times of the year. Representatives of government sometimes referred, during the key informant interviews conducted by the preliminary study in 2014, to the ‘exclusive use’ of the Ziga dam/reservoir (à vocation unique), but the presence of fishing points to this as misleading.

51 Boreholes with hand pumps.

52 It would be useful for a further study to add information from rainfall records to verify this, to the extent it is available.

53 ‘The flooding spreads further on the denuded land’ said the men’s focus group in Ziga village.

2.2 Climate

As for the factors influencing the viability of the agriculture in the area, low rainfall was of most concern to the greatest number of persons interviewed (93%). The other factors were: the cost of agricultural inputs (e.g. seeds) (76%), lack of available land (58%), lack of water for irrigation (52%) as well as the low sale price of produce (29%). All those factors were reported to be of concern in the current year.

Other natural phenomena reported were: wind storms (84% of respondents), loss of trees/vegetation (81%), heat waves (75%), flooding (74%) and parasites/pests (65%).

The significance of low rainfall was echoed in the focus groups: in each of the four villages the perception was that the rainy seasons have become shorter and more variable, with the rains beginning later and stopping sooner. That makes for nine dry months of the year. The men of Ziga village had observed, for example, that grass dried out quicker and sooner than it used to when the climate was more humid, making for less pasture. According to the focus groups in Kolkom, 2016 was a very dry year with a poor harvest.

When the rains do come, said the women of Absouya village, they are more unpredictable: ‘Sometimes we have good rains, but often now they are either very heavy or very light, either drowning crops or drizzling at them, or stopping altogether, without providing enough moisture to grow well. Each year, we have to try to anticipate what is coming. We plant varieties of seed with shorter growing periods in case of dry weather.’

50 There are norms for fishing on Ziga Lake – namely, fishing nets of a prescribed minimum mesh (35 mm), no artificial techniques for frightening the fish into the nets and no fishing very close to the dam (within 5 m) for safety reasons and to avoid snagging of the release gates. Apart from these, people are free to fish, day and night. In other words, the fishing is regulated, but not banned, as a use that is compatible with the primary use of drinking water supply, including at different times of the year. Representatives of government sometimes referred, during the key informant interviews conducted by the preliminary study in 2014, to the ‘exclusive use’ of the Ziga dam/reservoir (à vocation unique), but the presence of fishing points to this as misleading.

51 Boreholes with hand pumps.

52 It would be useful for a further study to add information from rainfall records to verify this, to the extent it is available.

53 ‘The flooding spreads further on the denuded land’ said the men’s focus group in Ziga village.
In so doing, we know we risk missing the opportunity of good rains’. The changes to the climate have been happening for some considerable time, observed the men of Ziga village, for over 20 years, but before, when they had access to water in the low-lying areas of the Nakambé valley bottom, they did not feel the impact of the changing conditions’.  

Of the 207 persons surveyed, 202 - i.e. 98% - said that their families had been affected by drought. The droughts have been recurring over the past 15 years, with a majority of respondents recalling a drought in each of the three most recent periods of five years. Furthermore, droughts are becoming more prevalent (or at least more perceptible and memorable for more village members) with 72% saying that the droughts experienced were severe. Only one respondent out of 205 said that their household had not been affected by drought (with two not replying to the question). 95% of persons interviewed said that the possibility of drought was a major concern for their agriculture in the current year. Past floods had occurred mostly during the past 10 years. When the floods had happened, they were severe. Floods are a major concern for this year, said 60% of persons interviewed. The flooding generally affects the fields and roads rather than the houses, except that Bissiga had experienced a major flood event 5 years ago, when houses in the village were flooded. The families were helped by the Red Cross (source: focus group). Two children from Kolkom had tragically been drowned in a flood on the way to school - the village needs a bridge (source: focus group).

At Absouya, they said they had noticed an increase in cases of malaria since the construction of the dam (source: focus group discussion).

Asked again as to their state of mind in the face of climatic phenomena, 91% of persons interviewed expressed overall pessimism for the future of their agriculture over the coming five years.

2.3 Migration

Migration is a very significant reality in the lives of the villages surveyed.

Of the 207 persons interviewed, 90% reported that a member of his/her family had migrated out of the locality (the destinations of the migrants and typical periods of time away are discussed in this Section below). In Bissiga and Absouya, for example, the proportion of departures is greater (96%), whilst in Nagréongo Koudogo, for example, less (80%). Many of the respondents (a little less than half) reported recent departures, in 2016 or 2017.

Migration from the Ziga area is very predominantly male: only a few female members of the households surveyed have left the villages. It is the young men who go away to find work elsewhere, including several males from a single household - in total 547 persons had migrated from the 207 households surveyed, i.e. on average 2.6 persons per household (the large majority of the participants in the focus groups were women or old men).

The migration from the eight villages is largely seasonal. 78% of respondents across the eight villages said that the migrants from their household intended to return. The migrants generally spend six months of the year away, leaving in October/November and coming back in March/April ready to work with other family members in planting of the fields. In other words, the year is divided into two parts, one when the young male members of the community are present, and the other when they are not. The highest rates of return are, reportedly, in the villages of Ziga, Beta, Bissiga and Gondogo, with more of a mix (according to this sample) of both returnees and permanent migrants in Absouya, Nioniogo and Nagréongo Koudogo.

As for the stated reasons for migrating, in the responses to the survey, lack of access to water for irrigation was rated as ‘very important’ by 98% of persons interviewed, alongside poor/degraded soils at 90% as well as drought and irregular rainfall at 85% and 83% respectively. Another major factor influencing the decisions to emigrate was noted as being the lack of work opportunities in the villages (97%), e.g. in agriculture. Regarding the lack of water for irrigation, in six villages (out of the eight villages surveyed) all the respondents said that this was a ‘very important’ factor influencing departures, with poor and degraded soils ‘very important’ for all the respondents in five villages (out of the eight).

54 The expression used in this focus group was ‘climate change’ in Mooré, the local African language.
55 Of the persons interviewed, 82% recall a drought affecting their family in the past five years, namely 2011-2016, with decreasing proportions of the respondents recalling floods in the previous periods of five years: 2006-2010: 61%; 2001-2005: 57%; 1996-2000: 41%; 1990-1995: 26%.
56 It would be useful for future research to provide information on levels of migration from rural villages in other parts of Burkina Faso.
The nearby town of Ziniaré was mentioned as a place which did not provide many employment opportunities. Based on the responses to this survey, there does not seem to be any link between the rate of migration from a particular village and the services available in that village. According to the focus groups, life is more difficult in the villages of Kolkom and Ziga than in, for example, Bissiga and Absouya which are (somewhat) more prosperous. Kolkom has very few services – the dirt road to the village is bad and there is no electricity, school or health centre – while Bissiga has a good access road - it is located beside the main, tarmac road north from Ziniaré and it has an electricity supply, a school and a health centre, as shown in Table 1. In Bissiga and Absouya, however, the rates of departure exceed that in Kolkom and the rate in Ziga (based on this sample) is close to the average (87%). Nagréongo Koudogo, a village without electricity and a health centre (although with reasonable road access), seems to be the least affected by migration (at 80%).

The principal reported reason for those who stay in the village is the responsibility of looking after a family member (children or old people). The decision to leave is taken by the migrant and the head of the household with other family members consulted, including the extended family (much less friends and neighbours and village elders). In most cases, the cost of migrating is met by sale of animals or out of other savings.

Most migrants (76%) are reported as having gone to places elsewhere in Burkina Faso, with the remaining few to other countries. The destinations in Burkina Faso mentioned in the focus groups and responses to the survey are as set out in Table 2.

Destinations in other countries referred to in the survey responses or the focus groups are: the Ivory Coast, Mali (the gold mines), and Niger, instead of Senegal and Guinea in the past noted the men’s focus group in Bissiga.

As reflected in Table 2, according to the survey and the focus groups, this migration from the villages surveyed is largely rural-to-rural. According to the focus groups, the migrants make use of their skills base in agriculture and also in making charcoal. In the former case, the destination of the migrants is, in many cases, places where there are opportunities to use irrigation waters to grow vegetables and fruit – near water bodies, e.g. dams, large, medium and small. There are, however, some signs of refusal by the existing residents in the areas where the incoming migrants wish to farm. During the focus group discussions in Absouya, for example, the group of men recounted how their family members had been told: ‘You have a dam where you come from! Why do you expect to settle here?’

A few family members migrate to urban areas, particularly Ouagadougou, where they work for example in construction (to learn brick laying) (source: the focus groups in Kolkom) or small businesses (source: Bissiga focus groups) or as apprentice mechanics. More men would go to the city ‘if they had the relevant skills’. The hiring on construction sites may frequently be on a daily basis, considered, therefore, as a source of salaried work which is precarious. For a few who have done well at school, the city offers the possibility to obtain diplomas and access to other more secure jobs.

Table 2: Destinations within Burkina Faso of migrants from the villages

<table>
<thead>
<tr>
<th>Regions within Burkina Faso</th>
<th>Location in Burkina Faso (nearest centre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-east</td>
<td>Dori (near the border with Niger)</td>
</tr>
<tr>
<td>Centre-north</td>
<td>Yako</td>
</tr>
<tr>
<td>Centre</td>
<td>Korsimoro (north of Ziniaré)</td>
</tr>
<tr>
<td>Centre</td>
<td>Goudry</td>
</tr>
<tr>
<td>Centre</td>
<td>Ouagadougou</td>
</tr>
<tr>
<td>Centre-west</td>
<td>Near Kompienga</td>
</tr>
<tr>
<td>West</td>
<td>Boromo (between Ouagadougou and Bobo-dioulasso, the second city of Burkina Faso)</td>
</tr>
<tr>
<td>Centre-west</td>
<td>Léo (very near the border with Ghana)</td>
</tr>
<tr>
<td>Centre-south</td>
<td>Manga</td>
</tr>
<tr>
<td>East</td>
<td>Fada-Ngourma</td>
</tr>
<tr>
<td>West</td>
<td>Bobo-dioulasso</td>
</tr>
</tbody>
</table>

Source: Responses to the questionnaire for this study.

57 The nearby town of Ziniaré was mentioned as a place which did not provide many employment opportunities.
As for migration to Ouagadougou, out of the 17 places in Ouagadougou where the migrants from Ziga area are reported as residing (according to the responses to the survey and focus groups), 14 are located in the poorest (most outlying) parts of the city, namely in the two lowest categories of the National Demographic and Statistics Institute (INSD) in terms of relative prosperity as contrasted with poverty. Further study could usefully find out how the migrants are faring in the urban context. Most migrants are reported (73%) as contributing to family finances by sending remittances, whether regularly or occasionally. The funds sent are used to buy food and other goods, or pay for health or education.

The participants in the men’s focus group in Kolkom village said that the migration caused a big upheaval in the village. Two of the village focus groups mentioned that, when the young men of the village were away, those that remained ‘found it difficult to find someone to repair a house or dig graves for the deceased’. ‘What would happen if all the young men left?’ A question in village members’ mind is whether, at some point, the migrants (at least some of them) will cease to come back, if they find they are earning reliable income from work in the new place, or if they meet another woman there (source: the Kolkom focus groups). ‘Single young men may be more inclined to stay away’ (source: Absouya focus group) or those who have managed to establish themselves in secure jobs in the town/city. ‘Whole families do not generally leave’ (source: Absouya focus group).

There is recognition that migration is necessary. ‘When a young man expresses the desire to leave, the family accepts and wishes him well’ (source: Kolkom focus group). ‘The need for young men to go away to look for work is an accepted principle – better than them staying at home without work and causing trouble’. ‘It would be good if they could stay in the village without the need to migrate’ said Absouya focus group participants. ‘There is a tradition of some young men going away to explore other places. Now it is the majority that go because they have to’, noted the men in Ziga village.

The focus group of men at Kolkom commented that migration was much less before the construction of the Ziga dam.

According to the people surveyed, opinions are divided as to whether the overall effect of the departures from the village is positive or negative - almost equally. ‘When the men return, they come back with new skills and money and they inject dynamism into the village’ (source: Absouya focus group). For the views of the women expressed in the focus groups, see Section 2.4.

The respondents clearly anticipate that migration from their villages will continue over the coming 10 years and will even increase in the view of some.

2.4 Role and perspectives of women

With husbands, brothers, sons away for months of the year, the women of the villages face a heavy work load. As well as caring for children and aged parents and carrying out household tasks, they have to try to combine additional income earning activities with looking after livestock (goats and poultry) while the men are away.

The small business ventures referred to in the focus groups include market gardening (maraîchage) to grow and sell vegetables (where they have access to irrigation), making foods and preparing drinks for sale (e.g. millet beer), fabricating ropes (Bissiga) and baskets or soap, or producing clothing, or setting up cafes (Absouya, and at the road-side in Bissiga). At Bissiga, girls sell nuts and fruit by the road. In the more remote villages with less passing trade (Beta, Nioniogo, there are fewer people to sell to, and, in all the villages, with the men away (e.g. Ziga and Kolkom) fewer village members present for much of the year. The journeys to and from markets in towns such as Ziniaré are long and difficult.

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58 The INSD data comes from the most recent census in Burkina Faso which was carried out in 2006 (a new census was due in 2016, but was postponed).

59 And mothers-in-law looking after daughters-in-law (focus group in Kolcom).

60 The results of the survey of 1,379 farming households in Burkina Faso, the report of which has been published by the OECD (OECD/ISSP, 2017), ‘suggests that the migrants, when they leave, are replaced by other household members’ (page 95), i.e. instead of there being recruitment of external labour.

61 There are less natural materials for making baskets than before because land on which the creepers (lianes) grew was flooded by the Ziga reservoir (source: focus group in Kolkom).
As to the income from these businesses, the women in Bissiga reported that profit margins varied according to the price of inputs and after paying the rental charge on vegetable plots beside the one dam at Lélégsé which affords the village access to irrigation for market gardening. With more money and time to devote to their commercial activities, the women said they could make their businesses better.

When children fall ill, the women have to manage alone. The lack of health facilities in three villages (Nagréongo Koudogo, Gondogo and Kolkom) means that there is no maternal health care in the village so that women generally give birth at home in the village. The women of Kolkom told stories of women giving birth by the road side on the way to the clinic in the next village.

In two villages (Ziga and Kolkom), the women are extracting sand and breaking up stones/rock to make gravel for sale which they said was hard labour. This, they said, made them tired and more prone to illness. This quarrying by the women began after the construction of the Ziga dam. The sale of sand and gravel provides an additional source of income for the women and their families. Prior to the dam, it was the young men who did the extraction of sand and gravel, while the women grew vegetables in the humid low-lying areas. After the filling of the Ziga reservoir, the cultivation of those areas was no longer possible, so the women took over the quarrying and many young men migrated.

In the focus group discussions with the women, they talked about how they wish they did not have to be separated from their husbands and they intimated as to what that means in their personal lives and the social life of the village. The women of Ziga said that it is difficult to be separated from their family members. They felt ‘abandoned’ – and, when the men come back, it is not the best time of year, they said (in March/April, it is generally the hottest time of the year). This echoes the thoughts of the male focus group at Absouya. ‘It would be better if the men could stay and work in the community’.

As to whether both the men and women could migrate, with their children, the women said they cannot – they have their parents to look after in old age.

The women of Ziga and Bissiga mentioned help from NGOs. A member of the Ziga women’s focus group said that she has received training in keeping poultry which was useful, but that the NGO had left without providing any start-up resources which was not useful.

The women nevertheless expressed hopes as well as fears for the future. The women of the Bissiga focus group, for example, put hope in their children’s education to help advance the lives of the next generation. The women of Kolkom commented that ‘No son of the village is (as yet at least) a civil servant’. The women of Absouya, a more prosperous village, said that ‘there is still a good life in the village’ (source: focus group).

As for the realities of migration, the women’s focus group in Bissiga noted that some men manage to make a success of working away, while for others it is a failure financially. Nevertheless, many come back with new experiences and ideas and that means attitudes in the village are changing.

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62 The owners of the land are other inhabitants of Lélégsé who possess plots by the small dam in their village. The rental cost of the plots varies according to the distance from the water body. The rental charge for a quarter of a hectare varies between 15,000 and 10, 000 FCFA depending on whether a plot is close or further away from the water.

63 These are 200 square metre vegetable plots available for hire by 50 people, for three month periods (source: men’s focus group at Bissiga).

64 The dam at Lélégsé was built before the Ziga dam and is in working condition, although sediment has built up reducing its capacity to store water (source: men’s focus group in Bissiga). The present study has not measured precisely the height of the dam at Lélégsé, but, after the visit to Lélégsé by the first author of this report, it is clear that the height of the dam is more than 5 metres which means that it corresponds (in terms of height) with the classification of a ‘medium dam’ according to the National Dams Committee (le Comité National des Barrages du Burkina) (CNBB, 2015).

65 During the women’s focus group at the Ziga village, they observed that cattle may often be bought using the funds brought home by the migrating young men. For these agricultural communities, having cattle is a means of holding capital, making and keeping savings. The women did not talk of those funds being invested in their own businesses. This may happen, but it was not mentioned.

66 The survey did not capture how care of aged parents was shared or divided, allowing perhaps some siblings to leave the village.
3. Conclusions and recommendations

‘The change in the climate has been happening for 20 years, but, when we had access to water in low-lying areas, we did not feel the impact of the changing conditions’ (source: male members of Ziga village).

‘We have fears for the future, because, as time passes, life in the village is becoming more difficult’. As to the need to invest in alternatives: ‘With more resources, we could find better solutions’ (source: the men and women of Ziga village).

This section sets out the conclusions from this research and proposes recommendations for policy-makers.

3.1 Conclusions

For the eight villages surveyed by this study in the area around the Ziga dam and reservoir - in the semi-arid zone of Burkina Faso - the dam has negatively affected their economic status and prospects because of the impact on their agriculture. This significantly reduces their resilience to changing climatic conditions. The villages are bearing a disproportionate part of the costs of the Ziga project.

They are ‘exporting’ for six months of the year their prime male labour force, in great numbers, to take part in agriculture elsewhere. They are looking to the women to take on additional responsibilities that would have otherwise been assumed by the men.

This is the means for survival – in the common language of climate change an ‘adaptation’ strategy. It is, however, a strategy that comes at considerable cost to family and village life. The focus groups spoke, for example, of difficulties finding the labour to repair a house or dig graves for the deceased, with wives saying they felt abandoned.

The problem is the combination of irregular rainy seasons, drought and the lack, in most cases, of water for irrigation. As noted above, in line with forecasts of climatic variability, the villages are experiencing shorter and more unpredictable rainy seasons. These factors are key drivers of departures.

The geographical area which is the focus of this study is both special and typical. It is special in the sense that the communities did have ready access to water in the past, and do not now. The loss of 8,000 hectares of good, fertile lands under the Ziga reservoir (when full) means that the village members are struggling to cultivate poor soils. The construction of the Ziga dam and the flooding of the land in the valley bottom have in other words resulted in a major change to the villages’ access to natural resources – land, water and vegetation. It is typical in that it illustrates the difficulties faced by rural communities in Burkina Faso who seek to rely on rain-fed agriculture. Even using techniques such as stone bunds (cordons pierreux) and zaï for retaining the humidity in the soil, rain-fed agriculture in semi-arid areas is a struggle, especially in the context of a shortage of labour (as noted in Section 2.1).

The changes to the climate have been observed by the Ziga communities as happening for some considerable time with droughts occurring over the past 15 years and more. And they are becoming more prevalent. The villages are also affected by other natural phenomena: wind storms, loss of trees/vegetation, heat waves, flooding and parasites/pests.

67 As noted in Section 2.3, it is the young men who go away to find work elsewhere, including several males from a single household - in total 547 persons had migrated from the 207 households surveyed, i.e. on average 2.6 persons per household.

68 As noted in Section 2, lack of access to water for irrigation was rated as ‘very important’ by 98% of persons interviewed, alongside poor/degraded soils at 90% as well as drought and irregular rainfall at 85% and 83% respectively. Another major factor influencing the decisions to emigrate was noted as being the lack of work opportunities in the villages (97%), e.g. in agriculture.
The overall impression is of great vulnerability. Village members are pessimistic for the future of their agriculture in their village. Their pessimism may be linked (based on the results of the survey) to the exodus of young men and consequent lack of labour (for half of the year).

The communities are working hard to adapt, including taking up business to create alternative sources of income, but those measures are not sufficient to make up for the failure of their agriculture in/around their home villages to provide enough for their food needs. Migration is a necessity, more than a choice. The villagers remaining said it would be preferable if the young men could live and work off agriculture at home instead of having to go away.

The women work very hard, including working in (small) quarries to extract sand and break up stones/rock to make gravel for sale - to the point, they said, it affects their health.

The difficulty for the villages is made worse by poor roads and remoteness - ‘enclavement’ in French.

Village members understand the ban on irrigation on the shores of the Ziga lake. They accept the need to keep the reservoir free from polluting chemicals (pesticides and nitrates) to maintain the quality of the water for drinking for the benefit of the residents of Ouagadougou. It is the lack of other, small irrigation infrastructure of which the villages in the Ziga area complain – the lack of support to neighbouring communities in terms of works ancillary to the main dam. ‘Where’, the villagers say, ‘are the small dams we were promised?’ They feel this as a significant injustice.

The report of the preliminary study in 2014 raised the question whether one consequence of failure to support rural communities in the development of new irrigation options or other livelihood opportunities might be their abandoning of those communities to migrate to urban areas, thereby increasing water demands in cities/towns. The replies to the present survey tend to indicate that that is largely not the case. According to the survey and the focus groups, this migration from the villages surveyed is largely rural-to-rural.

The destination of the migrants is, in many cases, places in Burkina Faso where there are opportunities to use irrigation waters to grow vegetables and fruit (maraîchage) – near water bodies, e.g. dams, large, medium and small. There are, however, some signs of refusal by the existing residents in the areas where the incoming migrants wish to farm. During the focus group discussions in Absouya, for example, the group of men recounted how their family members had been told: ‘You have a dam where you come from! Why do you expect to settle here?’

Destinations in other countries referred to in the survey responses or the focus groups are: the Ivory Coast, Mali (the gold mines), and Niger.

3.2 Issues arising and recommendations

The problem of insufficient opportunities for irrigation faced by the communities in the Ziga area could be resolved by construction of small dams based, as noted in Section 1.5, on documented examples of other communities in Burkina Faso as reported by Katic et al, 2014 where the building of small built water storage infrastructure in low-lying areas (bas fonds) increased the quantity, duration and reliability of water available to farmers and provided significant economic benefits from their agricultural production (Katic et al, 2014, page 92).

The question arises where small dams with small reservoirs fit in the strategy of the Burkina Faso government. The National Plan for Economic and Social Development 2016-2020 (PNDES) sets out the government’s ambition to increase the contribution of irrigated agriculture to overall national agricultural production from 15% in 2015 to 25% in 2020 (PNDES, page 66).

That target sounds good, but how is it to be achieved? By construction, it seems, of large dams.

The PNDES refers to the new dams built from two in 2015 to 14 in 2020 as well as increasing the number of newly rehabilitated dams from two in 2015 to 18 in 2020 (PNDES, page 69).

The emphasis in the PNDES on large dams is confirmed by the following statement:

[Currently there are] ‘more than 1,018 dams and 790 water surface reservoirs, spread nationwide. However, more than 95% of dams are made up small facilities with less than 10 meters height and 80% have a capacity of less than one million cubic meters’ (page 40).

A priority of the Burkina Faso government with donor backing (e.g. from the World Bank) is support to special agricultural zones called agropoles where agricultural investment and activity is to be concentrated. Examples of agropoles are Samendéni, Sourou and Bagré.70

What does a village or group of villages do if its local dam is not designated as the centre of an agropole? Migrate - in increasingly large numbers? In the Nakambé river basin the pressure on water resources is likely to grow with increasing rainfall variability as well as population growth.

Previously, the Ministry of Agriculture and Water Resources (MAHRH) has recognised the need in Burkina Faso for support to small-scale irrigation projects as well as small-scale livestock-rearing projects. A MAHRH analysis of the projects that it funded in 2006 (Tigasse, 2014) noted that half of the projects (28 out of 56) in that year under the MAHRH heading of ‘Support to growth, diversification and intensification of [agricultural] production’ were for small water storage projects using the natural topography of low-lying areas (les bas fonds). As noted in the present report, this is one important means for collecting and storing water in relatively small quantities (e.g. compared with the Ziga dam) for relatively short periods. The aim of increasing water storage is to reduce vulnerability to climate variability (periods of low rainfall). The previous national development plan for the period 2011-2015 (the ‘SCADD’) stated that:

70 Sourou is located on the northern border with Mali. The Sourou River is a tributary of the Mouhoun. Samedeni is also on the Mouhoun River, 50 km from Bobo-Dioulasso in the south-west of the country.
‘the pace of creation of water storage for small irrigation (la petite irrigation) will be accelerated’ (alongside larger irrigation schemes) in order to realise the ‘potential for development of the bas fonds’ (GoB, 2011).

The key informant at MAHRH to the 2014 study explained these small water storage points could be formed by excavation of the earth and then shoring up of the banks using local materials such as stones collected ‘wild’, instead of concrete, plus plastic sheeting. In other words, these can (as noted in Section 1.1) be ‘low-tech’ and relatively low-cost structures comprising a large natural element using earth.

Will there still be support to small-scale irrigation in the new era of the PNDES?

According to the Facebook page of the Ministry of Agriculture (on April 12th, 2017) and subsequent reports in the Burkinabé press, the Ministry is to lead a donor-funded project to map (in digital form) suitable sites to be part of a national programme for development of low-lying places (les bas fonds). The mapping will take 2 years and the goal of the programme to 2030 will be ‘to secure agricultural production, strengthen food security and promote economic growth’.

The question arises whether the villages in the area around the Ziga dam will be included in the mapping and then subsequently investments in small dams made to benefit those villages as part of this initiative. The Ziga villages certainly need such support. It would redress the injustice that the local communities feel.

In this connection, the PNDES has noted (page 17):

> ‘the ‘strong social demand for justice and security, access to employment, quality infrastructures and social services’ of the Burkinabé people after ‘the recent socio-political and security situation culminating with the popular insurrection of October 30th and 31st 2014, the attempted coup of September 16th, 2015 and terrorist attacks of January 15th, 2016’ (emphasis added).

As for the position of women in Burkina Faso, the PNDES has observed (page 25) that:

> ‘despite progress recorded, inequalities in monetary poverty, education, employment, access to production resources and elective positions are still strong, in particular to the disadvantage of women and young people’ (emphasis added).

Despite their endurance, it is clear from this study that particularly the women of the villages in the Ziga area are suffering as a result of the current predicament of their communities.

The Burkinabé government, supported by donors, can reduce inequalities and support more inclusive, resilient economic opportunities for rural communities by financing a national programme of investment in small dams and reservoirs, including in the Ziga area. Prioritising the construction of large dams to supply urban drinking water and energy without addressing the needs of rural communities exacerbates social and economic inequalities.
Woman selling fruit by the roadside. © CIFOR/Olivier Girard
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References


Annex: Scope and focus of questionnaire

Section A: Base information (identity of village and household)
Section B: Agriculture and Water
Section C: Climate
Section D: Migration

Section A: Base information (identity of village and household)

Household name
District (commune)
Village
Position of village (upstream or downstream of the Ziga dam)
Name of respondent (and contact number)
Gender of respondent
Name of head of household
Marital status of head of household
Number of wives of head of household
Number of children
Number of family units within the household (sous-ménages): independent, or under the head (sous tutelle)
Number of household members of different ages (less than 15 years; 15-59 years; over 59 years)
Relation of the person being interviewed to the head of the household
Number of years of residence of the family in the locality (are they long-standing residents of the area, or new?)
Principal activity of the household
Secondary activity of the household
Number of household members (aside the head) having paid work
Number of household members (aside the head) carrying out a commercial activity or trade
Section B: Agriculture and Water

Do you have land (as owner - whether by rental or loan or gift)?
Number of hectares of cultivated land
Who in the household decides what to grow/produce?
Number of adult men of the household working in these fields
Number of adult women of the household working in these fields
Number of children of less than 15 years of the household working in these fields
Irrigation: all/part/none of this cultivated land is irrigated?
Principal irrigation source: small dam; canal; collection of water from a low-lying area (bas fonds); well or borehole; other (or more than one of those things)?
Secondary irrigation source: “ ” ” ” ” ”
Do you have access to the water in the reservoir of the Ziga dam for irrigation of your fields?
If not, why not? prohibition by the operator of the dam; the fields are far from the reservoir; lack of means, financial or technical; competition with others; you are not seeking to obtain access; other (or more than one of those things)?
Is your agriculture viable (rentable)?
What are the factors/reasons which affect the viability or non-viability of your agriculture: high cost of inputs, e.g. fertiliser; reduction of overall land availability; loss of land for cultivation; low prices for sale of agricultural products; lack of water for irrigation; lack of labour; low rainfall; other (or more than one of those things)?
To what is your cereal production aimed: household consumption; sale; food for animals; other?
What proportion of your production during the past three years has gone for sale: all; almost all (75%); half (50%); just a small part (25%); almost nothing; other?
In your view, what are the factors which could affect your agricultural income this year, in 2017: high cost of inputs, e.g. fertiliser; reduction of overall land availability; loss of land for cultivation; low prices for sale of agricultural products; lack of water for irrigation; lack of labour; low rainfall; other (or more than one of those things)?
Overall, are you optimistic, or pessimistic, for the future of your agricultural activities over the five coming years?
Do you own animals?
How many heads of cattle?
How many sheep or goats?
How do you water your animals: e.g. directly in the Ziga reservoir; by collection of water from a low-lying area (bas fonds); from a well or borehole; other (or more than one of those things)?
Section C: Climate

Has your household been affected by one or more of the following natural phenomena: drought? heat wave? loss of trees/desertification? flood? parasites? high winds? Weeds (mauvaises herbes)? other?

In what time-frame has your household been affected by drought: 2016-2011; 2006-2010; 2001-2005; 1996-2000; 1990-1995; never affected by drought?

The drought(s) were of what intensity: high; medium; low?

In what time-frame has your household been affected by flood: 2016-2011; 2006-2010; 2001-2005; 1996-2000; 1990-1995; never affected by flood?

The flood(s) were of what intensity: high; medium; low?

In your view, what are the natural phenomena which could affect your agricultural activities this year, 2017: drought? heat wave? loss of trees/desertification? flood? parasites? high winds? weeds? other?

Overall, are you optimistic, or pessimistic, for the future of your agricultural activities in the face of climatic conditions over the five coming years? Why?
Section D: Migration

Has a member of your household migrated away from the area?
If yes, please provide: name (and contact number) and gender of the migrant(s), plus his/her destination.
When did the migrant(s) leave home for his/her most recent trip away?
Principal motivation of the departure: permanent work; seasonal work; training; other?
Principal activity before his/her departure?
If the destination of one of the migrants is the capital, Ouagadougou, in which district/place is s/he living (plus contact no)?
In your case, why have you not migrated? Why are you still in the village: wish to carry on agriculture; wish to stay in the village; do not wish to be separated from family; responsibility to look after family members; not enough resources to leave; no relations to help at the destination; other (each graded in terms of great importance, importance, or lack of importance)?
If you did have the possibility to leave your village, where would you go to, and why?
Who, in general, makes the decision to migrate: the head of the household; the migrant; by family agreement; other?
Did the members of your household who have migrated consult the other family members?
If someone in your family has to migrate, who will most likely go, among family members between 15 and 59 years? Why?
Apart from your family, with whom do you discuss strategies and decisions relating to migration; with friends and neighbours; village elders; the wider family; other?
What are the factors/reasons which influence the decision to migrate: (each graded in terms of great importance, importance or lack of importance): lack of a school in the village; insufficient health services in the village; family reasons (death, marriage, lack of parents); because of friends; other social reasons; better opportunities in the town; friends already living in the town; conflicts over natural resources; few possibilities of work in the village/area; lack of available agricultural land; less cereal production or animal production for sale; lack of access to water for irrigation; poor and degraded soils; irregular rainy seasons; parasites; flood; drought; other natural phenomena; decline in cereal production for household consumption; fewer financial resources to buy food; other food security issues?
When family members leave, who helps them at their destination: other family members; friends or neighbours from the village; nobody; other?
How does your family manage the costs of migration: savings; borrowing; sale of harvest or animals: sale of other goods; non-agricultural income; remittances of funds to parents; other?
In your view, are the effects of migration on your village positive or negative?
Do the migrants intend to come back to the village?
If yes, will that return be permanent or temporary?
If they do not intend to come back, why is that?
How many of the migrants in your family have come back this year?
Why did they come back?
How do you see the future over the coming 10 years for the young people in the village?
Has your household received help from the family members who have migrated?
If yes, how do the migrants provide help: regular transfers of funds; occasional transfers of funds; material support (e.g. tools, food, presents, etc); other forms of help; no help?
If yes, what do the transfers represent relative to your family’s annual income in the village: less than half; half; more than half; more than 100%.
What does the household do with the transfers: purchase of food; purchase of other goods of consumption; pay health costs; pay education costs; pay back debts; other?
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