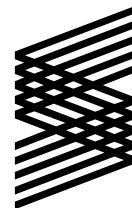




**The urban–rural water interface:
A preliminary study in Burkina Faso**
Working paper



PRISE
Pathways to resilience
in semi-arid economies

Research for climate–resilient futures

The urban–rural water interface: A preliminary study in Burkina Faso

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This report has been produced as part of a series of preliminary papers to guide the long-term research agenda of the Pathways to Resilience in Semi-arid Economies (PRISE) project. PRISE 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.

Front cover image:

Water Work, Ziniare, Oubritenga Province, Burkina Faso

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The report's findings and conclusions are those of the authors and do not necessarily reflect the positions or policies of IDRC/DFID or ICI/BMUB. For more information, contact Peter Newborne (p.newborne.ra@odi.org) and Josephine Tucker (j.tucker@odi.org.uk), or Guy Jobbins (g.jobbins@odi.org.uk).

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

The goal of **WISE-UP to Climate** – Water Infrastructure Solutions from Ecosystem Services Underpinning Climate Resilient Policies and Programmes – is to promote the formulation by decision-makers of climate change-robust investment plans that combine built and 'natural' infrastructure – both civil engineering and natural management – allocating social and economic benefits in a cost-effective and equitable manner. Decision-making on allocation requires assessment of different infrastructure options, including identification of trade-offs between options where necessary. The project is supporting the development of knowledge on how to use mixed portfolios of built and natural infrastructure for poverty reduction, water–energy–food security, biodiversity conservation and climate resilience in the Volta basin (with a focus on Ghana and Burkina) and the Tana basin in Kenya.

Contents

List of Figures	7
List of Tables	7
List of Boxes	7
Acronyms	8
Summary	10
1. The urban–rural water interface	11
2. Ouagadougou and Ziga: urban and rural	21
3. Equity	25
4. Integration and inclusion	32
5. The urban–rural water interface: preliminary conclusions; suggestions for further research	43
References	45
Annex: Lake Guiers, Senegal – a case of multiple use?	48

List of Figures

Figure 1	Location of major dams including Ziga and Bagré on the river Nakambé in the Volta Basin	13
Figure 2	Climatic zones of Burkina	14
Figure 3	Evolution of urban and rural populations in Burkina, 1960-2030 (% rate of increase)	15
Figure 4	Regions and provinces of Burkina	21
Figure 5	Examples of infrastructure on a spectrum between 'natural' and 'built'	24
Figure 6	Area of management of the Nakambé River Basin Agency	37
Figure 7	Strategic Development Plan for Greater Ouagadougou to 2025	39

List of Tables

Table 1	Contributions to economic growth, 2012 (%)	16
Table 2	Volume of potable water sold by ONEA to urban centres in Burkina, 2013	27

List of Boxes

Box 1	Urbanisation, economic growth and poverty	17
Box 2	Urban water services in Ouagadougou and equity 2001-2007 – a patchy record	18
Box 3	Irrigation downstream of the Ziga dam	28
Box 4	Fishing on the Ziga reservoir	30
Box 5	IWRM institutional structure in Burkina	32
Box 6	National planning for adaptation to climate change – recommended actions	34
Box 7	Strategic Development Plan for Greater Ouagadougou to 2025	40

Acronyms

AEN	Nakambé River Basin Agency
AfDB	African Development Bank
AGRHYMET	Agriculture, Hydrology, Meteorology
BMUB	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CARIAA	Collaborative Adaptation Research Initiative in Asia and Africa
CEDRES	Centre for Economic and Social Study, Documentation and Research
DFID	UK Department for International Development
DGRE	Directorate-General for Water Resources
DREDD	Regional Directorate for the Environment and Sustainable Development
FAO	Food and Agricultural Organization
FEWSNET	Famine Early Warning Systems Network
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoB	Government of Burkina Faso
ICI	Initiatives, Conseil International
ICI	International Climate Initiative
IDRC	International Development Research Centre
IIED	International Institute for Environment and Development
INSD	National Demographic and Statistics Institute
IRD	Institute for Research for Development
IUCN	International Union for the Conservation of Nature
IWMI	International Water Management Institute
IWRM	Integrated Water Resources Management
MAHRH	Ministry of Agriculture and Water Resources
NAPA	National Adaptation Programme of Action
NGO	Non-Governmental Organisation
ODI	Overseas Development Institute
OMVS	Senegal River Basin Authority
ONEA	National Office for Water and Sanitation
PNIA	National Programme for Agricultural Investment
PNSR	National Rural Sector Programme
PRISE	Pathways to Resilience in Semi-Arid Economies
SAGE	Sub-Basin Plan
SALs	Semi-Arid Lands
SCADD	Strategy for Accelerated Growth and Development
SDAGE	Strategic, Basin-Wide, Development Plan

SDAGO	Strategic Development Plan for Greater Ouagadougou to 2025
SDE	Senegalese Water Utility
SE4ALL	Sustainable Energy for All
SONABEL	National Electricity Company
UK	United Kingdom
UN	United Nations
UNDP	UN Development Programme
UNICEF	UN Children’s Fund
VBA	Volta Basin Authority
WHO	World Health Organization
WISE-UP to Climate	Water Infrastructure Solutions from Ecosystem Services Underpinning Climate Resilient Policies and Programmes

Summary

Decisions on water allocation and infrastructure lie at the heart of development planning in semi-arid lands.

On paper, the laws and policies of Burkina Faso accord equal entitlement to drinking water for the residents of cities and the residents of small towns and villages. In practice, Ouagadougou's status as economic and administrative capital gives it much greater power to plan for and mobilise investment for its own water supplies. The Ziga project (in two phases) has been designed to secure bulk water supply for Ouagadougou until 2030.

For local people in the Ziga area on the White Volta/Nakambé River, the project has brought some positive benefits and some negative impacts. Thriving rural communities need water for productive use, yet the government bans villages around the Ziga reservoir (upstream of the Ziga dam) from irrigating from the lake (to protect water quality from the use of polluting chemicals) and they are not receiving support to create alternative revenue-generating activities. 'Development', said a local leader, 'is based on social peace. As long as we do not receive assistance in recognition of the consequences of the dam, there is a problem that needs to be resolved.'

The national development strategy identifies both urban and rural areas as priorities in the promotion of economic growth, without expressly favouring either. The livelihoods of the great majority of Burkinabé are based on agriculture, although the rural economy is particularly vulnerable to climatic shocks (variability in rainfall). Urban planners, meanwhile, are looking to secure water supplies and maintain water and other basic services in the city to support the urban economy.

The reach of Ouagadougou's water infrastructure is long, already 50 km to the Ziga dam – with ambitions to extend it further – around 220 km to the Bagré dam. The size of the Ziga reservoir means it is expected to have unused water capacity, in the short and medium term, even after the construction, soon, of Ziga Phase 2 – a second water main to Ouagadougou.

The population of Ouagadougou is, however, growing at a fast rate, and this is forecast to continue, with an expected doubling of the population by 2030 and then, potentially, another doubling by 2050. Currently, the Bagré dam provides water for hydropower and irrigation - not urban water supply. It cannot be assumed that Bagré would be able to serve Ouagadougou with both hydroelectric power and water supply in sufficient quantity at the same times because of different levels in the filling of the Bagré reservoir, year by year and season by season, owing to variability in rainfall. In dry periods, extraction from the Bagré reservoir for drinking water would reduce the amount of water available for much-needed hydropower generation. There seem, in other words, to be major competing water demands in prospect, involving choices between different priorities.

In the long term, therefore, without review of the urban–rural water balance in the national economy and society to anticipate the potential trade-offs and analyse infrastructure options by way of response, the 'train' of the capital's urban growth risks running into the 'buffers' of pressure on water resources in the context of climate variability, including shorter and more unpredictable rainy seasons.

1. The urban–rural water interface

1.1 Introduction

The principle that water for drinking and domestic use takes precedence over other water uses is commonly enshrined in national laws and policies. Urban areas with substantial residential populations accordingly expect to receive a priority water allocation. As cities have grown in contexts of increasing pressure on water resources, case studies have begun to emerge of water transfers and ‘reallocations’ from rural to urban areas. Cities commonly include, however, a range of different types of water user – commercial and industrial as well as residential – and the issue arises as to the status of city water entitlements vis-à-vis the water rights of rural communities. In semi-arid zones – the focus of the Pathways to Resilience in Semi-Arid Economies (PRISE) project – this is a particularly important question.

Where these water transfers require new or altered infrastructure, the related question arises as to what (single) purpose or (multiple) purposes the infrastructure will be built for in each case – water supply, energy, irrigation, livestock or other uses – and for whose benefit. Will water be conveyed long distances to urban centres by major works of civil and mechanical engineering, or will new urban areas be planned and constructed near rivers or lakes, as natural features of the environment?

A further issue concerns the institutions and decision-making

processes by which infrastructure priorities are determined. What mechanisms (if any) are applied for assessment of different infrastructure options? The focus of the WISE-UP to Climate (Water Infrastructure Solutions from Ecosystem Services Underpinning Climate Resilient Policies and Programmes) project is on mixed portfolios of built and ‘natural’ infrastructure (as defined below).

The proposition considered in this report is that, in semi-arid zones, which face climate variability, with the likelihood of increasing pressure on water resources, decisions on water management will increasingly require strategies for allocation of water resources between urban and rural areas. Among economists, there is a tendency to argue for a systematic reallocation of water from rural to urban uses, on the basis that ‘water is too often devoted to economically inefficient, “low return” (agricultural) uses and that transfers to more efficient, “high-return” (urban) uses would increase total economic welfare (Molle and Berkoff, 2009). Others challenge that view (ibid.).

Accordingly, there needs to be analysis and debate as to the appropriate urban–rural water balance in the national economy and society. For achievement of climate-resilient development in semi-arid contexts, choices will need to be made between different and sometimes competing priorities, with due consideration of equity and inclusion as well as due

attention to maintenance of ecosystems and the environment.

1.2 Why Burkina?

The focus of the present report is Burkina Faso in West Africa, with a proposal for study also in Senegal in the same region. The ‘selected experiences’ of water transfers¹ that Molle and Berkoff refer to in their useful overview of (as they call it) ‘cities versus agriculture’ in water management are drawn from Asia, Latin America, the US, Europe and North Africa (Molle and Berkoff, 2006; 2009). No examples from Sub-Saharan Africa are given. This gap has been partially filled by Komakech et al. (2012), who have documented a case in East Africa².

In Burkina, the capital city, Ouagadougou, is located in the centre of the national territory, in the central plateau, which is semi-arid (as Section 1.2 further describes). Ouagadougou is not situated beside a major river, in contrast with the second-largest city of Burkina, Bobo-Dioulasso, in the south-west.³ Ouagadougou draws most of its water – 70%, according to the urban water utility, the National Office for Water and Sanitation (ONEA) (GoB, 2013) – from the reservoir of the Ziga dam located 50 km to the north-east 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 along with the Mouhoun (or ‘Black Volta’, also flowing into Ghana), the Comoé and the Niger tributaries.⁴

¹ Some water transfers or ‘reallocations’ are temporary, during dry periods. Others are permanent, including those made following formal administrative decisions of government to appropriate and divert water sources, with or without compensation.

² The case of the Pangani river basin in Tanzania, where ‘powerful cities selectively use the law to gain leverage on water control’ by a combination of ‘administrative decision and stealth’ (Komakech et al., 2012).

³ Bobo-Dioulasso is located on the Houet River in the province of the same name, which is one of the more humid in Burkina with a Soudanese climate (rainfall between 1,100 mm and 1,200 mm a year).

⁴ The Nazinon (‘Red Volta’) basin is a sub-basin of the Nakambé.

Ziga is also in a semi-arid area. The Ouagadougou-Ziga case, as Section 1.3 further describes, is an example of rural to urban water transfer. The Ziga project, in its two phases, is described in Sections 2.2 and 2.3.

In many places in Burkina, watercourses are not perennial. 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 points for at least part of the dry season.

On the Nakambé in Burkina, the Ziga and Bagré dams comprise the major existing built infrastructure⁵ - see Figure 1. Section 2.4 describes the Bagré dam.

Both the urban population of Ouagadougou and the urban and rural populations in the area near Ziga require water for drinking and domestic, as well as productive, uses. Under Burkina law, drinking water use is highest in the hierarchy – the first listed in Article 1 of the 2001 Water Policy Management Act (GoB, 2001). The 1998 National Water Policy adds that the first objective is to ‘satisfy sustainably, in quantity and quality, the water needs of a growing population and an economy in development’ and specifies that ‘in relation to access for water for drinking, the different categories of population must be treated equitably’ (GoB, 1998, emphasis added). Section 3 discusses equity issues.

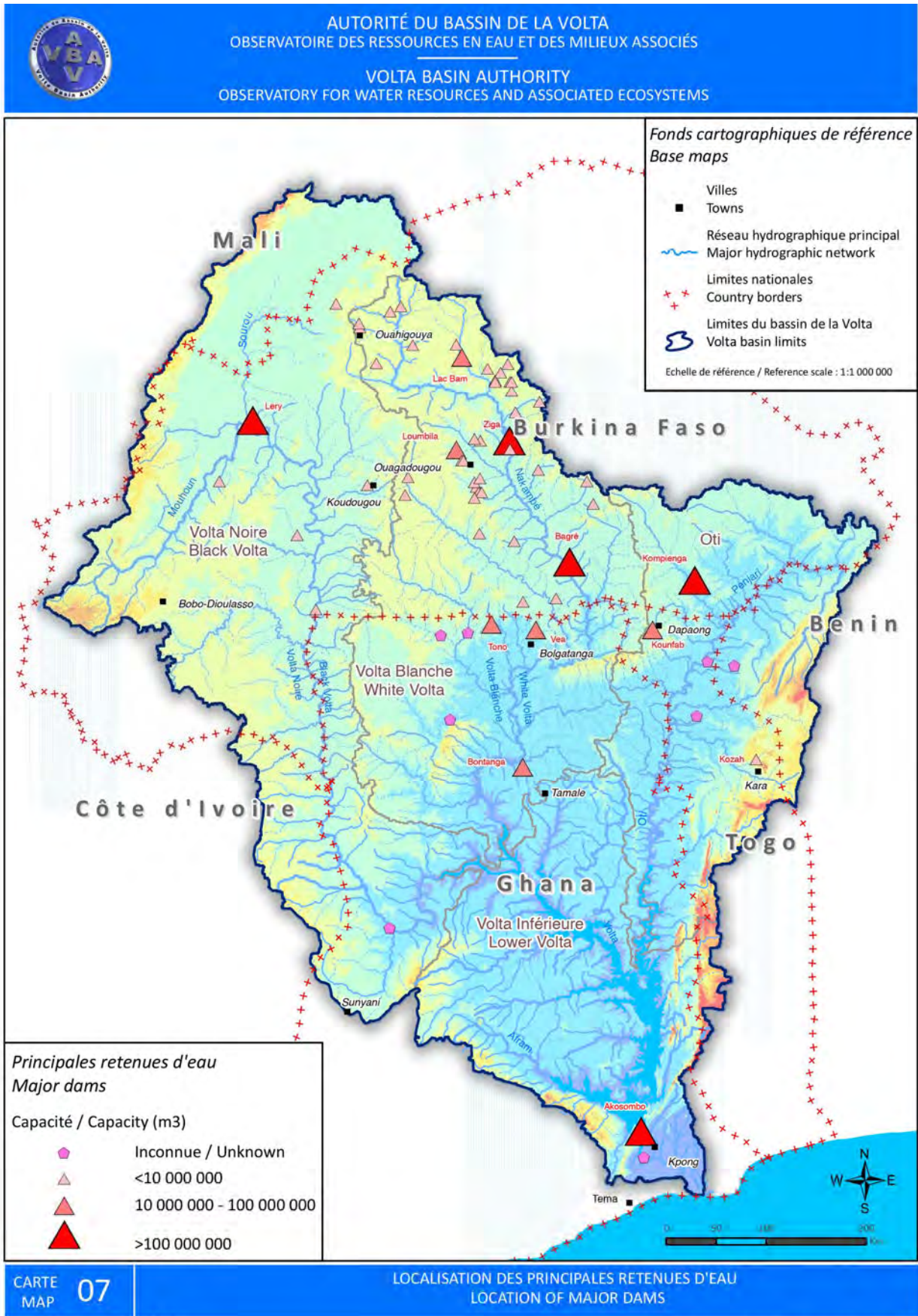
As regards other uses, Article 1 of the 2001 Act continues that the goal of water management is to ‘satisfy or reconcile the demands of agriculture, livestock, fishing and aquaculture, extraction of minerals, industry, energy production, transport, tourism, leisure and all other legally-exercised human

activities’ as well as ‘water quality’ and ‘protection of aquatic ecosystems’ (GoB, 2001). The government, through the ministry responsible for ‘integration of water resources’ (Article 13) – the Ministry of Agriculture and Water Resources (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. As set out in the 2006 Human Development Report, satisfaction of the demands of different user groups requires taking account of competition for access to water as well as any competition for water itself. ‘Water scarcity’, note the authors, is commonly a function of ‘power, poverty and inequality’, not ‘physical availability’ – that is, a result of ‘institutions and political choices’ (UNDP, 2006). In Burkina, ‘integrated water resources management’⁶ is noted (GoB, 2003) as being the ‘foundation’ of the national water strategy. Section 4 discusses how far the principle of ‘integration’ is to-date being applied, or side-lined, by institutions and politics in the Ouagadougou-Ziga case, and the extent of inclusion of local people in consultation on planning and decision-making.

⁵ The Bagré dam is located near the frontier with Ghana and the manner of its operation is of interest and concern downstream. Past releases of water have sent flood-water into Ghana, causing deaths and damage. A system of warnings before releases has been instituted.

⁶ In French, gestion intégrée des ressources en eau (GIRE), hence the title of the national integrated water resources management (IWRM) plan in French: PAGIRE.

Figure 1: Location of major dams including Ziga and Bagré on the river Nakambé in the Volta Basin



Map supplied courtesy of the Volta Basin Authority.

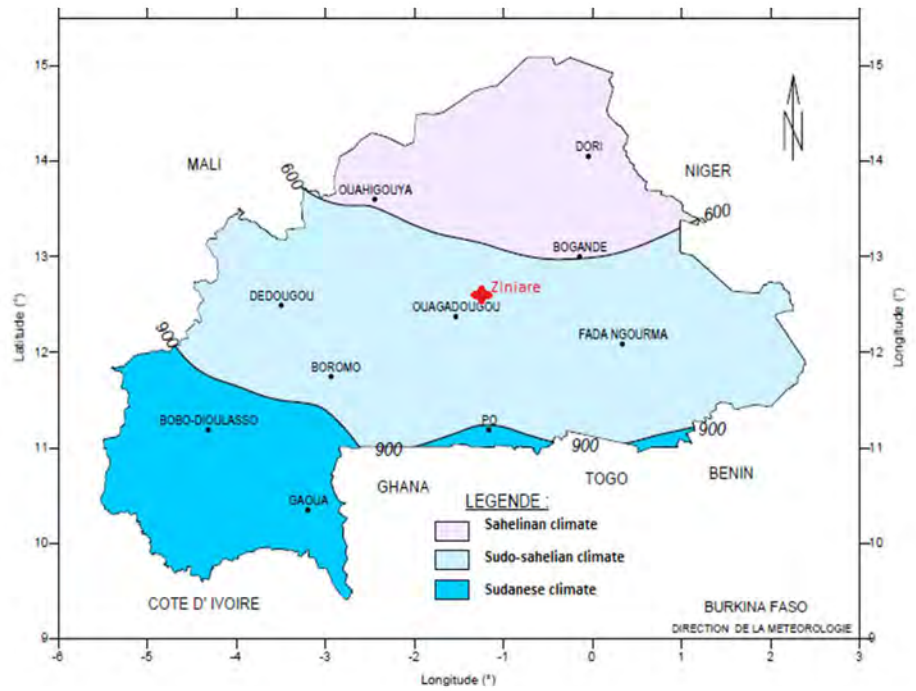
1.3 Burkina context

There are three climatic zones in Burkina (see Figure 2): the arid sahel in the north, with typically average annual rainfall of less than 600 mm; the semi-arid 'soudano-sahelian' zone in the centre, with average annual rainfall of 600-900 mm; and the dry sub-humid 'sudanese' climatic zone in the south, with average annual rainfall of 900 mm (Wetta et al., 2015 forthcoming).

Burkina has two seasons: a long dry season and a short rainy season. In the semi-arid central zone, the rainy season is about 5 months, typically from May/June to September/October. In the arid sahel in the north, the rainy season is typically shorter - 4 months at most. In the southern zone, the rainy season lasts nearly 6 months (Wetta et al, 2015 forthcoming).

As for information on evolution of the climate in Burkina, this study has not carried out any new research, relying instead on existing sources, including by other papers produced for the PRISE project. The past three decades have seen signs of increasing variability in rainfall distribution, temporal and spatial, manifested by shorter and more unpredictable rainy seasons (Wetta et al., 2015 forthcoming; FEWSNET, 2012).⁷ This has serious implications for agriculture in Burkina, which is mainly rain-fed. According to the Strategy for Accelerated Growth and Development (SCADD) 2011-2015 (GoB, 2011), Burkina was expected to move from, at the beginning of the 2000s, 'a situation of moderate water stress in a normal year and moderate/high stress in a very dry year' to a 'permanent situation of high water stress in 2010-2015' with 'water demand reaching 69.7% of utilisable volume in a normal year and 141.9% in a very dry year'. 'Pollution (domestic,

Figure 2: Climatic zones of Burkina



Source: FAO (2010).

agricultural, urban) exacerbates the water deficit' (ibid.).

A key point to note is that 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. According to the AGRHYMET (Agriculture, Hydrology, Meteorology) Regional Centre, the continuing drought in the western part of the Sahel (Senegal and western Mali) contrasts with the situation in the eastern zone (Chad, eastern Niger), which is experiencing a return of wetter conditions (AGRHYMET, n.d.). As to which situation prevails in the central zone where Burkina is located, the sources are inconclusive. Some climate projections forecast higher, and some lower, rainfall. The sources are, however, in agreement as to increasing climate variability affecting Burkina in more unpredictable rainy seasons including the occurrence of shorter rainy seasons in some years. In the remaining sections of the present

report, the focus is on climate variability rather than (human-induced) climate change.

As Section 4 discusses, it is not clear, based on this preliminary study, how far water-related decision-making in Burkina is taking climate aspects into account (the climate information challenge discussed in Jones et al., 2015).

As for the status of natural resources in Burkina, according to the SCADD (GoB, 2011), '34% of the national territory, amounting to 9,234,500 hectares, is in a degraded condition due to human (agriculture, livestock, land occupation, wood for energy, etc.) and climatic causes, with an estimated annual addition of 105,000 - 250,000 hectares of degraded land'. 'The phenomenon of degradation is observed to affect an estimated 74% of land in arid and semi-arid areas' (ibid.).

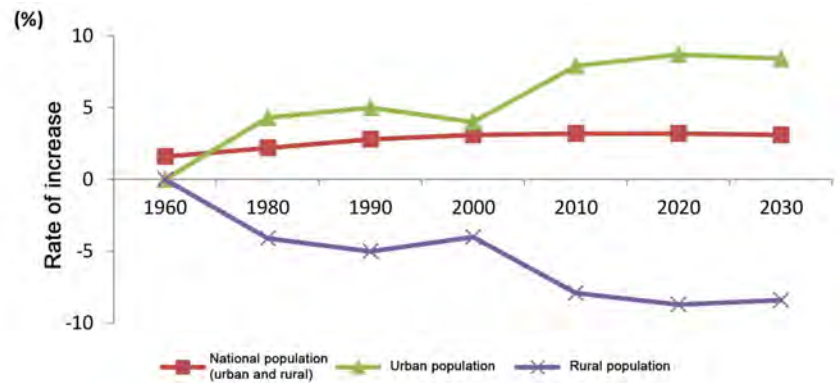
The topography of Burkina is notable for the generally flat relief

⁷ 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.

with only a few elevated areas.⁸ The population of Burkina has tripled in the past five decades, from 4,317,770 inhabitants in 1960 to 14, 017,262 in 2006, with growing rates of increase – from 2.8% per year in 1991 to 3.13% in 1996 and 3.42% in 2006 according to the National Demographic and Statistics Institute (INSD, 2011). At the rate of 3.1% increase per year, the country is forecast to have a population of 18,450,494 in 2015 (ibid.). The population of Burkina is young: according to the SCADD, 46.4% of the population of 14,017,262 (as per the 2006 census) is under 15 years, and 59.1% under 20 years (GoB, 2011). Figure 3 shows the evolution of urban as compared with rural population growth, with a rate of urban growth of above 5% per year, in the context of population growth overall (urban and rural) of 3% per year.

As for migration, whereas in 1985 only 21.7% of the population of Burkina at that time reported to the census survey that they had migrated, in 1993 this figure was up to 30.7% (Wetta et al., 2015, forthcoming). The principal motivation of migrants is the search for a better standard of living (ibid.).

Figure 3: Evolution of urban and rural populations in Burkina, 1960-2030 (% rate of increase)



Source: 2006 census (INSD, 2008).

⁸ The elevated areas are, in the west, the Piton de Bérégaougou at 717 m, dominating the plane of Banfora, and Mount Ténakourou at 749 m, which is the highest in the country; and, in the south-east, the chain of the Gobnangou hills at 500 m on the frontier with Benin.

Despite the increase in the urban population, the population overall is still predominantly rural (70%) with the majority of Burkinabé – 80.9% - reported to be working in ‘agriculture, hunting and forestry’ (INSD, 2011). The SCADD (GoB, 2011) identifies the primary sector of ‘agriculture, livestock, fishing and forestry’ as a priority for development, stating that ‘economic growth in Burkina is dependent on its agriculture’. It also notes, however, that the primary sector contributed only 30% of gross domestic product (GDP) in 2012⁹ (Table 1). The share of the ‘tertiary’ services sector is much larger, 46%. The small contribution of the secondary sector as shown in Table 1 (21%) reflects the low level of industrialisation in Burkina Faso.

Table 1: Contributions to economic growth, 2012 (%)

Sector	Contribution to growth (2012) *	% of working population **	% of GDP produced ***
Primary	3.3%	78.9%	33%
Secondary	0.8%	3.7%	21%
Tertiary	3.9%	16.4%	46%
Total	8%	99%	100%

Sources: * INSD website; ** INSD (2008; 2012); *** <http://www.insd.bf/n/index.php/indicateurs?id=62>

⁹ Page 86 of the SCADD sets out 2009 figures.

Given that the primary sector, predominantly rural, accounts for just a third of national product, it is not surprising that, alongside growth of the rural economy, the SCADD identifies as a national priority the promotion of economic growth in urban centres, stating there is ‘under-urbanisation’ in Burkina (GoB, 2011). Previously, in 2008, the National Policy for Housing and Urban Development had also commented that the urbanisation rate was one of the lowest in West Africa (GoB, 2008). The SCADD further observes the primary sector is ‘vulnerable to external shocks’ including ‘climatic uncertainties’ (GoB, 2011). This is an important consideration for policy-makers, although vulnerability in the primary sector is mirrored by vulnerability in other parts of the economy. Burkina has, the SCADD notes, been affected by external events such as oil price fluctuations and the financial crisis post-2008.

In summary, the SCADD looks for stable economic growth in both the urban and rural economy without expressly favouring either.

In terms of the living standards of households in Burkina, the SCADD notes that poverty is worse in rural areas in Burkina: according to a 2009/10 study, 50.7% of the rural population lives below the poverty threshold, compared with 19.9% in urban contexts (GoB, 2011). In 2013, poverty levels in the Centre region were the lowest in Burkina (INSD, 2011), while the Nord region was the poorest, with 68.1% households living below the poverty threshold. Overall, the 2009/10 study pointed to 43.9% of the population living below the threshold of poverty, estimated at FCFA 108,374 per adult per year (equivalent to \$218.53 at the July 2013 exchange rate), as compared with 46.4% in 2003, when the threshold was at FCFA 82,672 (\$166.70). In other words, despite a decade of economic growth – around 5% per year on average

over the eight years from 2003 to 2010 – poverty in Burkina has reduced little: it was at 48.66% in 2003 and it remained at 46.7% in 2009 (Kouraogo, 2012).

Lucci (2014) notes that most studies on the economic impacts of urbanisation focus on the relationship between urbanisation and economic growth, while links to poverty remain little studied (Christiaensen et al., 2013). The positive and negative effects of urbanisation have been the subject of comment by economists – see Box 1.

Box 1: Urbanisation, economic growth and poverty

Conceptually, many economists have argued that a move out of agriculture to more remunerative off-farm activities in urban areas would set in motion a virtuous circle by means of which new and more productive economic opportunities would be generated.

According to this view, poor rural workers would gain directly as they increase their incomes through internal migration. Their families in rural areas would benefit through remittances and increased demand for goods and services from urban areas. At the same time, migration would decrease the availability of agricultural workers, putting an upward pressure on agricultural wages. In this way, by increasing economic activity and job opportunities, urbanisation could help reduce poverty.

Another strand of the literature within economics points to additional benefits from the concentration of economic activity, referred to as ‘agglomeration economies’ (Fujita et al., 2001). Producers in certain industries can benefit from locating closer to suppliers and consumers; companies can also profit from having a greater choice of workers; and the concentration of people can foster a greater exchange of ideas and innovation. Depending on the type of jobs agglomeration economies generate (i.e. whether they create opportunities for the unskilled poor), they could have poverty-reducing effects.

Alongside the economic benefits of urban transformation, there may be negative effects. As more people concentrate in cities, transport and housing costs rise and so does congestion, generating diseconomies of scale. At some point, the latter can become a problem and a barrier to further growth. In addition, urbanisation can bring about new poverty problems if services and infrastructure do not keep up with growth. There can also be undesirable effects, such as the irreversibility of urban migration, as poor people may be locked into new informal settings owing to high migration costs (Christiaensen et al., 2013).

Source: Lucci (2014).

In short, as Box 1 describes, not all growth is poverty-reducing, and the same applies to urbanisation. While, in principle, urbanisation is associated with the creation of new and more productive economic opportunities and can have a positive impact on poverty reduction, how this process is managed is critical in order to avoid new urban poverty problems, including gaps in basic services, for example water supply. The standard of water services in cities such as Ouagadougou depends as much on the distribution network and water infrastructure within the city as it does on the 'bulk' water supply to the 'gates' of the city. As for the latter, the issue of the economic rationality, or otherwise, of transferring bulk water from rural to urban areas was raised in Section 1.1 and is considered in Sections 3.4 and 5.1.

According to official 2012 figures, the proportion of the national population using an improved water source – piped water, public tap/standpipe, tube well/borehole, protected dug well, protected spring or rainwater – is 97% in urban and 76% in rural areas (WHO and UNICEF, 2014).¹⁰ These are aggregate figures relating to access; they do not tell the full story, including on pricing and affordability. This is illustrated by the status of water services within Ouagadougou as investigated by the Overseas Development Institute (ODI) for the international non-governmental organisation (NGO), WaterAid, in 2009/10: their study pointed to failures in implementing the principle of equity – see Box 2.

Box 2: Urban water services in Ouagadougou and equity 2001-2007 – a patchy record

In addition to building the Ziga dam and mains pipe from Ziga to Ouagadougou, the Ziga Phase 1 project was designed, over a six-year period, 2001-2007, to improve water distribution within Ouagadougou. ODI and its Burkinabé partners studied in detail the achievements and failings of the Ouagadougou Water Supply Project (formal project title). They applied a poverty 'lens', investigating how poor areas and households were included in the investments the project made. The research also took account of the stated aims of the further phase of work within Ouagadougou and in three other urban centres in Burkina,¹¹ to be carried out by the Urban Water Sector Project over a further six years, 2009-2015. That follow-up project was designed to expand distribution and access in the four cities – as per the project plan (World Bank, 2009).

The report on the ODI research study highlighted the following key points:

- The 2001-2007 project strengthened the capacity of ONEA and made significant progress in extending water infrastructure and services in the peri-urban districts of Ouagadougou, doubling the number of people in the city with improved water access.
- ONEA's subsidy to stimulate demand for household connections, called 'social connections', was made available to all households in areas beyond the centre that expressed the desire to connect, together with a reduced tariff for the first tranche of water consumption – i.e. the subsidy was not targeted to any peri-urban districts or customer income categories in particular.
- Data on the 'socioeconomic profile' of households in Ouagadougou collected by international consultants for ONEA in 2007 confirmed identifiably different levels of wealth/poverty in Ouagadougou's peri-urban districts.
- These data were not, however, utilised in designing the further phase of work (2009-2015); the data did not inform a strategy for targeting low-income areas and households.
- ONEA's subsidy continued to be applied universally; by not filtering out relatively wealthy households from their current eligibility to benefit from the social connection subsidy, people in poor peri-urban areas of the city were being made unduly to wait for improved access.
- As such, in the context of poverty in Ouagadougou, a key finding of the study was that ONEA's subsidy was too blunt an instrument to achieve the goal of equity set out in the national water policy – treating all customers' requests for connection to the network 'equally' would not achieve equity.
- Even with the subsidy, the reduced price was still not affordable for some poor households in surrounding areas far from the city centre.

¹⁰ Unimproved sources include unprotected dug wells, unprotected springs, surface waters (WHO and UNICEF, 2014).

¹¹ Bobo-Dioulasso, Koudougou and Dédougou.

As Box 2 refers to, in the poorer areas of Ouagadougou, especially slums located beyond the limits of the city as formally recognised¹², poor households were found to face major difficulties of access, travelling substantial distances to collect water from standpipes (e.g. situated at the boundaries of neighbouring formal ‘urbanised’ areas) and paying high prices for their water – in the dry season, two or three times the ‘regulated’ price at standpipes. The study concluded that ONEA lacked a city-wide, pro-poor targeting strategy (ciblage).¹³ Mapping by the researchers of ONEA’s extension of standpipes beyond the centre of Ouagadougou revealed ‘patchy’ inclusion of poor peri-urban zones. There had been no attempt by ONEA at poverty mapping for geographical targeting purposes, taking account of both formal and informal areas. Nor was ONEA organising customer data by income category. This meant that, despite the progress ONEA had achieved in installing water infrastructure and extending water services in Ouagadougou, it was unable to measure the benefits to low-income households in the city.

The research added that the objective of targeting low-income households needed, further, to be recognised in the performance contract (contrat plan) between the government of Burkina and ONEA, with MAHRH supporting and incentivising the articulation by ONEA of a national plan for targeting low-income households, by a combination of geographical

targeting of poor areas and targeting of poor households by household characteristics. Thereby, ONEA could be induced to remedy the patchy equity.¹⁴

For the purposes of the present study, it is important to emphasise that this owed to problems in distribution of water within Ouagadougou, not because of bulk water supply to the ‘gates’ of the city. In 2012, the bulk supply available, including (as seen in Section 2.2) the additional 40 million m³ provided by the building of the Ziga dam and the first mains pipe from the Ziga reservoir to Ouagadougou, was sufficient to meet overall demand.

1.4 A parallel case in Senegal

The case of Lake Guiers in Senegal presents an interesting parallel. Located 160 km from the capital, Dakar, Lake Guiers supplies more than two-thirds of the capital’s water. It is located in a semi-arid zone, with its water levels maintained by the Diama dam, built on the Senegal River in the 1980s. As well as being the principal water source for Dakar, Lake Guiers (at around 17,000 ha at high water) provides water for large-scale irrigation of cash crops (e.g. sugar cane), while local villages need water for drinking and domestic uses and carry out irrigation and fishing activities as part of their livelihoods.

The suggestion in Section 5.2 is that both the Ouagadougou-Ziga-

Bagré case and the Dakar-Lake Guiers case form part of further research on the urban–rural water interface.

1.5 About this preliminary study

This report sets out the findings of this study in Burkina. It presents a preliminary analysis of the Ouagadougou-Ziga case as a (pertinent) example of the urban–rural water interface. The intention here is to ‘frame’ the debate, posing questions at this stage and presenting preliminary findings without trying to offer comprehensive and definitive answers. Subsequent study can look in more depth at the drivers and shifts in water allocation and water-related investments at the urban–rural interface in Burkina and other study countries of the PRISE project, including Senegal.

The research team for this preliminary study comprised researchers based in Burkina and the UK. Each was involved in gathering and analysing available primary and secondary data. A member of the UK-based team visited Burkina to conduct, alongside his Burkinabé colleagues, key informant interviews including of government officials and representatives of utilities in Ouagadougou. The trip also included a visit by two of the researchers to the site of the Ziga dam and reservoir. The UK-based team drafted this report, with

¹² While ONEA’s strict mandate was to provide water infrastructure in the ‘urbanised’ areas formally incorporated within city plans (through the administrative process of urbanisation (lotissement in French – incorporation of new districts within the official city), in practice ONEA came to recognise the many people who live in the un-urbanised areas and extended its activities to them. The plan for the second phase of urban water services in Ouagadougou (2009-2015) referred to the need to ‘reduce the access bias between formal and informal settlements where, until recently, ONEA did not provide water services’ (World Bank, 2009).

¹³ The ODI/WaterAid project gave rise to discussion on targeting between ONEA and the lead Burkinabé researcher, as well as other experts.

¹⁴ In January 2015, additional funding of \$80 million was approved by the World Bank for urban water (and sanitation) services in Ouagadougou for a further three-year period (2015-2018). The project plan (World Bank, 2014) states that the proposed additional financing ‘aims to complement efforts already underway by ONEA to increase water production capacity by expanding the spatial coverage of the distribution system (including transmission mains and associated water storage facilities and pumping stations)’. It adds that the extra finance ‘will also help implement ONEA’s pro-poor policies to facilitate access to services through water connections and public stand posts in peri-urban areas and to address the specific challenges of access to services in informal settlements’. The project plan makes, however, no reference to a targeting strategy and, compared with the design of the previous two phases of work, the only change in the key performance indicators of the project is that half (50%) of the beneficiaries are to be female. In other words, an equity gap persists (based at least on the terms of this document as published by the World Bank).

advice and inputs from their Burkinabé partners.

The research trip to Burkina took place in December 2014,¹⁵ two months after the government of Burkina led by Prime Minister Luc Adolpe Tiao and President Blaise Compaoré was overthrown. Since then, Kafando Michel (a former senior diplomat) and Zida Isaac Yacouba (Lieutenant Colonel of the Army) have been overseeing a period of transition, whose principal objective is to bring about elections during the course of 2015. Since the violent period of the overthrow, the country experienced a period of calm (with some re-heightening of tension in April 2015¹⁶). A first measure of the transition administration was to suspend all elected representatives at national and local levels, given their association with the political parties that worked with the former regime. Under the Decentralisation Law of 2004, responsibility to provide urban water supply and other urban services lies with the local authorities (communes), of which there are 302 in Burkina. These are not expected to deliver services by themselves, but rather to delegate delivery to public or private bodies.

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. 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 purpose of the WISE-UP to Climate project is to develop knowledge on how to use mixed portfolios of built water infrastructure and 'natural infrastructure' for poverty reduction, water-energy-food security, biodiversity conservation and climate resilience. Section 2.5 gives an example of natural infrastructure in Burkina. ODI leads the political-economy component of WISE-UP. This report sets out preliminary insights on the political-economy of decision-making on water infrastructure in Burkina, as illustrated by the Ziga-Ouagadougou case, based on key informant interviews and other information collected during this study.

The report is organised as follows.

Section 2 describes in more detail Ouagadougou's drawing of water supply from the Nakambé River at the Ziga dam and the generation of hydroelectric power from the Nakambé at the Bagré dam, as well as the plans for Ziga Phase 2. Section 2.4 explains the relevance of Bagré to the urban-rural water interface.

Section 3 considers the positive benefits and negative impacts of the Ziga project on local people, including issues of equity.

Section 4 looks, through the Ouagadougou-Ziga and Bagré 'lenses', at the aims of 'integrated' water resources management in Burkina as compared with the realities, to-date, in practice, including the extent of inclusion of local people in consultation on planning and decision-making, as well as the likely implications of future growth of Ouagadougou in the context of climate variability including future competing demands over the use of the water in the Bagré reservoir.

Section 5 draws some preliminary conclusions and makes suggestions for further research.

¹⁵ In addition to two earlier visits to Ouagadougou by the same ODI researcher, in July 2013 for the Collaborative Adaptation Research Initiative in Asia and Africa (CARIIA) initiative of which PRISE forms part, and in April 2014 for the WISE-UP to Climate project.

¹⁶ The subject of the tension has been the proposal of an electoral law designed to exclude family members of the former president, Blaise Compaore, from participating in the country's forthcoming presidential elections. Despite the resignation of Mr. Compaore from the presidency in October 2014, after his attempts to amend the country's constitution and extend his presidential term limit catalysed widespread protests across Burkina, members of his family continue to hold positions of influence in the country. Supporters of Compaore's 'Rally for Congress for Democracy and Progress' (CDP) party argue that the proposed law will adversely affect their ability to choose a suitable candidate to contest the country's presidential elections, which are scheduled to occur later in 2015.

2. Ouagadougou and Ziga: urban and rural

“The bringing of water from the Ziga dam relieved Ouagadougou’s chronic bulk water supply shortages of the 1990s.” (ONEA representative)

This section describes:

- The expansion of Ouagadougou’s population and increase in its water demand;
- The two phases of the Ziga project for bringing bulk water to Ouagadougou, alongside hydro-electricity from Bagré;
- The role of small water storage tanks as examples of ‘natural’ infrastructure.

2.1 Ouagadougou city

In the 1960s, following independence, Ouagadougou was the administrative capital of Burkina, with Bobo-Dioulasso considered the economic capital of the country. Subsequently, Bobo-Dioulasso’s economic advantage vis-à-vis the capital declined as a result of government policy favouring Ouagadougou, especially during the 1980s and 1990s. Ouagadougou became the economic as well as the administrative capital.¹⁷ Its geographical position in the centre of the country is certainly favourable, as compared with Bobo-Dioulasso in the south-west in the Haut-Bassins region – see Figure 4.

Figure 4: Regions and provinces of Burkina



Source: INSD website¹⁸

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 the provision of water for the residents in the new peri-urban areas, including slums, which had grown 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 Centre region (INSD, 2011), increasing to an estimated 1,844,000 in 2012 (Guengant, 2011). The experience of the 10 years from 1996 to 2006 was of more than half of urban population growth occurring in Ouagadougou/the Centre region (53.1%), alongside 14.2% in Bobo-Dioulasso (GoB, 2008).

The population of Ouagadougou is still increasing at a fast rate, higher than the rate of national population growth of 3% (noted in Section 1.2). The UN cites population growth rates for Ouagadougou at 5.97% for the period 2015-2020, 4.95% for 2020-2025 and 4.25%

¹⁷ Despite a period since 2000 of growth in Bobo-Dioulasso.

¹⁸ <http://www.insd.bf/n/index.php/burkina/carte-du-burkina-faso/12-le-burkina>

for 2025-2030 (UN Population Division, 2014). At these rates, the population of Ouagadougou is forecast to be 2.83 million by 2020, 3.78 million by 2025 and 4.66 million by 2030. Assuming population growth continued thereafter – at rather lower rates to reflect a continuing downward curve in the degree of increase, at, say, 3.5% from 2030 to 2040 and 3.0% from 2040 to 2050 – the population of Ouagadougou would be 6.57 million in 2040 and 8.83 million by 2050. A 2011 study suggests the population levels of Ouagadougou (and Burkina) could be even higher (Guengant, 2011).¹⁹ In other words, from a 2010 baseline, the population of Ouagadougou is forecast to double by 2030 and then, potentially, to double again by 2050.

As for the government plan that aims to manage urban growth in Ouagadougou, Section 4.3 discusses this.

2.2 Ziga – Phase 1

From the 1940s/50s, Ouagadougou's principal water sources had been the No. 2 and No. 3 dams, with a maximum capacity of 5.5 million m³ and the Loumbila dam, built in 1947 and extended in 1970, adding a further 40 million m³ (ONEA, 2013). The lack of sufficient bulk water supply to meet the city's population demand in the 1980s gave rise to the project to construct the Ziga dam²⁰ on the Nakambé River, in the commune of Nagréongo, as noted in Section 1.1, 50 km away

from Ouagadougou to the north-east, and to lay a water main (1 m in diameter) from there to the capital. This first mains pipe from Ziga requires a water storage capacity in the reservoir of 40 million m³. The total volume of the Ziga reservoir when full is 200 million m³ over an area of 8,000 ha, with a 'useful volume'²¹ according to ONEA of 184.7 million m³ (useful volume is also sometimes referred to as 'live' or 'active' storage).²²

The terms of reference for Ziga Phase 1 were drawn up in 1984, followed by a feasibility study in 1985-1990, approval of donors in 1992, detailed studies in 1994-1996, construction of the Ziga dam in 1998-2000 and filling of the Ziga reservoir in 2000.

The Ziga reservoir displaced around 8,500 persons in 17 villages (ONEA, 2013). In terms of mitigation and compensation, the following measures were undertaken: '3 small dams for water storage and irrigation of 71 hectares were built at Absouya and Gaskaye, and at Nagréongo which was renovated', as well as '15 grain mills'; a 'forest management plan was established including re-planting of 185 hectares'; '21 boreholes were drilled for access to water in villages'; '95 kms of country roads were constructed' (ibid.). Local people contest the sufficiency and durability of these measures (see Section 3).²³

The provision of this new water source relieved Ouagadougou's chronic bulk water supply

shortages of the 1990s. Additionally, the two phases of investment supported by the World Bank and other external donor funds (2001-2007 and 2009-2015) have enabled ONEA, as the urban water utility, to extend the distribution networks and water services within the city, including partial extension into poor peri-urban areas²⁴. Since 1994, ONEA has been a state-owned company with a public mission, although it is required to run according to commercial principles. It has a board of directors and enhanced autonomy to manage its activities across all urban centres of the country (Newborne, 2010).

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 of 17.3 million²⁵ – that is, 8-9% of the total national population (according to INSD projections) putting a strain again on the city's water supply.

2.3 Ziga – Phase 2

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.

¹⁹ According to this study carried out by a demographic specialist at the Institute for Research for Development (IRD) (France) as part of a group of studies of trajectories of population growth in West African countries, the rate of increase of the population of Ouagadougou could take the total population to between 5 and 6 million in 2030 and above 10 million in 2050 (Guengant, 2011).

²⁰ The dam is 18.8 m high and the embankment is a little over 3 km long, with a spillway 120 m wide (ONEA, 2013).

²¹ '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 that 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.

²² It would be useful in a further phase of study to show the seasonal differences in the volume of water in the Ziga reservoir.

²³ For information and commentary on these measures from an environmental perspective, see Nebié (n.d.).

²⁴ As noted in Section 1.2, the research study carried out by ODI and partners on behalf of WaterAid pointed to the lack of a city-wide, pro-poor targeting strategy by ONEA in Ouagadougou with gaps in provision of standpipes in poor peri-urban areas (Newborne et al., 2010). As noted in Section 1.3, a further phase of additional financing for water services within Ouagadougou has been approved by the World Bank for 2015-2018.

²⁵ According to INSD's projection for 2013 ('key indicators' on INSD's website).

By way of response, a second phase of the Ziga project is planned. The intention, reports ONEA, is to lay a second mains pipe, parallel with the existing mains pipe – at 1.2 m in diameter bigger than the existing Ziga-Ouagadougou main of 1 m diameter – beginning the works soon, in 2015-2016. This will, according to ONEA,²⁶ double the volume of water ONEA can treat from the Ziga reservoir before the water is piped to Ouagadougou. 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 of approximately 100 million m³ per year.²⁷ 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.

For Ziga Phase 2, funding support of FCFA 104 billion, equivalent to approximately \$208 million, is to be made available by external donors (World Bank, African Development Bank (AfDB) and Islamic Development Bank). The call for tenders has been sent out.²⁸

As noted above, the need to construct a second phase of Ziga was anticipated at the time of conception of Ziga Phase 1. The Ziga reservoir was designed for an overall time ‘horizon’, according to ONEA,²⁹ of 2030, with 2015 marking the intermediate point

where Ziga Phase 2 needed to supplement Phase 1. The crest of the Ziga dam will not have to be raised as part of Ziga Phase 2 since, as noted above, the Ziga Phase 1 main requires a water storage capacity in the reservoir of just 40 million m³ out of a substantially greater total volume (200 million m³ when full, 184.7 million m³ of useful volume/active storage).

2.4 Bagré

While the designated purpose of the Ziga dam is supply of drinking water, the primary role of the Bagré dam, located near the border with Ghana at some 220 km from Ouagadougou (in the dry sub-humid climatic zone), is to supply electricity.³⁰ The Bagré reservoir was first flooded in 1992. It occupies 25,500 ha, with a maximum capacity when full of 1.7 billion m³ and an electrical generation capacity of 16 MW.

Levels of electricity access in Burkina are low, at 13.1% nationally in 2012, with a reported access rate in urban areas of 47% compared with just 1% in rural areas (SE4ALL, 2013) – a very low rate, even by Sub-Saharan Africa standards. The rate of access in the Centre region, where the capital, Ouagadougou, is situated, is substantially higher, at 41.3% in 2009 (GoB, 2011) than in the other regions, for example the Nord region at 7.3% and the Sahel region at 2.6% at 2009 figures again (GoB, 2011). In 2013, 42% of electricity in Burkina was imported,

principally from the Côte d’Ivoire and also from Ghana and Togo.

The operator of the Bagré dam is the National Electricity Company (SONABEL).³¹ SONABEL’s records as to the volume of river flows into the Bagré reservoir³² (recorded monthly, in two six-monthly periods) show that the Nakambé River at/above Bagré is not perennial. In the dry season from October/November to March/April, there are no (or low) river flows into the lake.³³ In the Bagré region, there are just six months of rain and river flows.³⁴ According to key informants, the Ziga dam (built in 2001) ‘is operated according to its own criteria’ without an agreement between the operator of Ziga (the urban water utility, ONEA) and SONABEL. The question arises as to how, in practice, the mode of operation of the Ziga dam and reservoir, as occurring in different seasons of the year, influences Bagré currently and will influence it in future – in particular, how increasing levels of water abstraction from the Ziga reservoir will affect downstream flows to Bagré. Further research could usefully consider this aspect.

²⁶ Key informant interview.

²⁷ It will be useful in a further phase of research to verify these figures.

²⁸ Key informant interview.

²⁹ Key informant interview.

³⁰ There are currently four hydropower plants in operation in Burkina. Bagré (at 16 MW) has the largest installed capacity (although small by international standards). The other plants are Kompienga (14 MW on the Oti River), Niofila (1.5 MW) and Tourni (0.5 MW) on the Mouhoun/Black Volta in the south-west of the country – with a further plant in course of construction at Samendeni (2.5 MW), also on the Black Volta. Other than hydropower, Burkina generates electricity with thermal power plants, running on diesel.

³¹ SONABEL (100% state-owned) is responsible for generation, transmission and distribution (i.e. the electricity sector in Burkina is not ‘unbundled’).

³² Including the flow into Bagré Lake of several tributaries of the Nakambé.

³³ One commentator in Ouagadougou has stated that in May and sometimes even in June there are no flows in the Nakambé upstream of Bagré.

³⁴ Key informant interview; the Mouhoun River is, in contrast, permanent, as is the Comoé.

Generation of electricity is not the sole purpose of Bagré. The lake is also used for irrigation, with a maximum potential of 30,000 ha. The 2010 baseline report on Bagré, nevertheless, comments that, 'When it is considered that 85% of the volume of water in the Bagré reservoir is allocated to electricity generation, the principal activity of Bagré is seen to be production of hydro-electricity. That is the reason why operation of Bagré was handed over to SONABEL' (ICI, 2010).

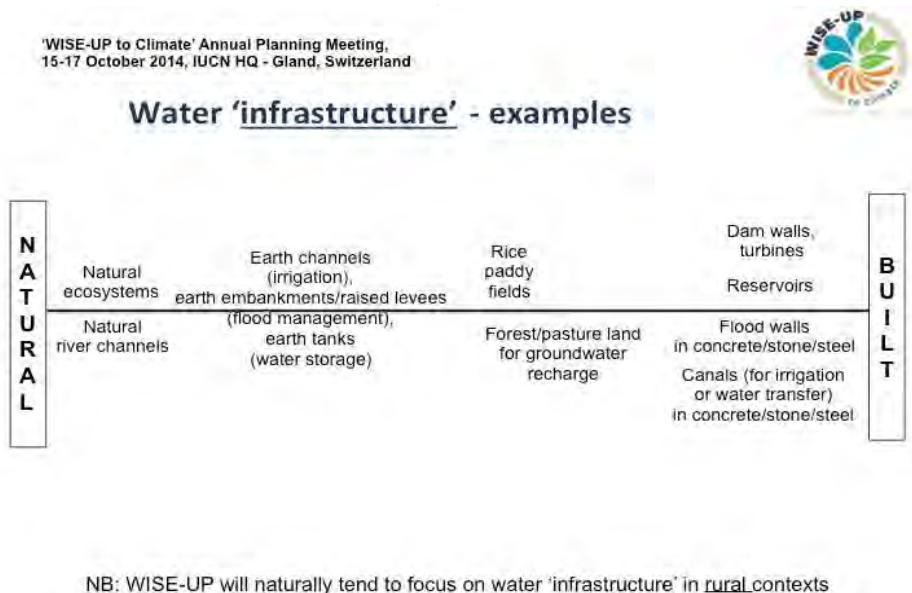
As discussed in Section 4.4, government officials referred to future growth of water demand in Ouagadougou and mentioned during the key informant interviews the possibility in the future of using the reservoir of the Bagré dam as a further source of water supply for the capital. The question arises: when in the future? ³⁵

2.5 Natural infrastructure/natural capital

As noted in Section 1.3, the WISE-UP to Climate project aims to show how mixed portfolios of built and natural infrastructure can be a 'nature-based solution' for climate change adaptation and sustainable development. The PRISE project, meanwhile, recognises the contribution natural capital can make, alongside human capital, to economic growth and social development.

While the ZIGA dam was a built infrastructure project, MAHRH has recognised the need in Burkina for support to small-scale irrigation projects (for market gardening – maraîchage in French) as well as small-scale livestock-rearing projects. A MAHRH analysis of the projects that it funded in 2006

Figure 5: Examples of infrastructure on a spectrum between 'natural' and 'built'



Source: IUCN (2014)

(Tigasse, 2014) notes that more than 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 Section 1.1, this is a common and important means in Burkina 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 SCADD states that '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 explained these small water storage points were 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. These are, in other words, 'low-tech' and relatively low-cost structures comprising a large natural element – the sort of 'earth tanks' shown on the spectrum in Figure 5 nearer the natural end.

As to low-lying lands in the Nakambé valley, which had previously been available as bas fonds, key informants from displaced villages reported how the Ziga reservoir had flooded those – as discussed in Section 3. As for the existence of other ecosystems of note in the Ziga area, key informants further told of the wooded area near Ziga (between the dam and Ziniaré) which had been listed as a protected forest some 40 years before, which is now in a degraded state (see below in Section 3.1).

Further study could usefully examine how far the bas fonds and other natural infrastructure in the Ziga area and the Nakambé valley more widely are being optimised – for local, regional and national development.

³⁵ Depending on seasonal, as compared with average, river flows, the margin for future capacity growth at Ziga suggests there could, first, be a Ziga Phase 3, although no mention was made of this in the key informant interviews.

3. Equity

“To bring drinking water to Ouagadougou, the Ziga dam flooded productive lowlands in this valley.” (local leader near Ziga)

“Ouaga, Ouaga! I’m fed up with just hearing about Ouaga. What’s going to happen to us?” (leader of local organisation near Ziga)

This section considers how far the principle of equity, as set out in Burkina water policy, is being applied, or side-lined, in allocation of water from the Ziga reservoir, and reviews the positive benefits and negative impacts of the Ziga project on local people. Equity relates to access to water and access to investment in water infrastructure.

3.1 Water – for drinking

As Section 1.1 noted, national water policy in Burkina calls for equity in allocation of water for drinking between different categories of population. How is this principle being applied in the Ouagadougou-Ziga case?

The water in the Ziga reservoir is reserved for use by the residents of Ouagadougou. In the key informant interviews in Ouagadougou, contradictory statements were made as to whether urban settlements along the route of the mains pipe from Ziga to Ouagadougou are connected. The urban mandate of ONEA applies to cities and towns – settlements with more than 3,500 inhabitants. The

town of Ziniaré is one place – the sources agree – that clearly has been connected to the Ziga-Ouagadougou main. The explanation for this is apparently that Ziniaré was the home-town of the recently deposed president, Blaise Compaoré. According to a presentation by ONEA at a workshop in Ziniaré organised in April 2013³⁶ by the Nakambé River Basin Agency (AEN) at the behest of the (then separate) Ministry of Water – after a visit in February 2013 by the minister that brought her attention to concerns over water quality in the Ziga reservoir – the drinking water supply network in Ziniaré comprised at that time 1,900 household connections and 54 public standpipes supplied from the Ziga reservoir (ONEA, 2013).

In contrast, no figure was supplied in the ONEA presentation for the network connections ONEA also said had been made to the town of Loubila, as well as other places along the route of the Ziga-Ouagadougou mains pipe.³⁷ Interviews with representatives of local communities told of the existence, to-date, in such places,

of standpipes, but not household connections, such as in Nagréongo, Koudgo and Boudtenga. It may be that these places are small settlements that fall outside ONEA’s responsibility and, instead, within the mandate of the department in MAHRH – the Directorate-General for Water Resources (DGRE) – responsible for rural water supply including settlements up to the 3,500 threshold.

In the villages and small towns that are the responsibility of DGRE, the infrastructure for drinking and domestic water consists, typically, of communal water points (boreholes), without household connections. Piped connections (taps in individual houses or to yards) are what ONEA aims to provide in the larger towns. Where the local geology makes boreholes difficult, DGRE says it plans³⁸ to fund multi-village schemes to bring

³⁶ The April 2013 workshop in Ziniaré brought together over 200 persons, representing a wide range of stakeholders as listed in an annex to the report of the workshop (GoB, 2013).

³⁷ Alongside the town of Loubila, ONEA also referred at the April 2013 workshop to network connections in Pabré, although it is not clear why it did so given that Pabré is located to the north-centre of Ouagadougou and it seems is not on the route of the Ziga-Ouagadougou mains pipe.

³⁸ Based on a current pilot in the south-west of the country, near Bobo-Dioulasso. The donors who continue to support DGRE’s work in rural villages are AfDB, the French Development Agency, the Danish International Development Agency, the German Federal Enterprise for International Cooperation, the German Development Bank, the European Union, the UN Children’s Fund and the World Bank (for studies on rural water).

A village café in the area near Ziga



© Peter Newborne/ODI

water supply (using electric pumps) to villages.³⁹ As for populations drawing water direct from rivers, the DGRE representative said villages used the river water for washing, but generally not for drinking – that it was ‘nomads’ (pastoralists) who used the river in that manner, especially in the dry Sahelian northern part of Burkina.⁴⁰

As for future connections, ONEA has stated⁴¹ that Ziga Phase 2 will include installation of secondary pipes off the to-be-built Ziga-Ouagadougou mains pipe to serve towns along the route.

The consideration of equity in relation to drinking water needs to

take account of the different roles of ONEA and DGRE and the different types of water infrastructure each deploys (as described above) – that is, to avoid a comparison that does not compare like with like. Those infrastructures may draw on different water sources, for example the surface water of the Ziga reservoir as compared with the groundwater supply to boreholes in villages of the Ziga area.⁴² The assessment could be made by comparing the extent of investment in each infrastructure type. Access to finance is a function of power, and access to investment funds

exercised by an urban utility as compared with the arm of government responsible for rural water supply is a manifestation of relative power. Section 3.2 presents a first (incomplete) attempt at a comparison of the level of investment in the infrastructure for urban water supply in Ouagadougou and the investment for local people in the Ziga area.

The people in the Ziga area this study consulted acknowledged the need for drinking water to be supplied to Ouagadougou. The sense of civic duty of the key informants in the Ziga area was striking, for example that

³⁹ In 2012, DGRE made a grant of FCFA 4 million to all the communes (for water supply), with FCFA 30 to 116 villages that needed rehabilitation of their water supply systems.

⁴⁰ Key informant interview.

⁴¹ Key informant interview.

⁴² The two may be connected in the sub-surface.

Table 2: Volume of potable water sold by ONEA to urban centres in Burkina, 2013

Client type	No. of clients	Volume of water invoiced (m ³)	% of total volume of potable water invoiced
Individual persons/households (including retired, with special tariff)	262,367	36,329,952	58.74%
Commercial and industrial premises	1,941	2,698,536	4.36%
Communes and local authorities	270	211,208	0.34%
Government buildings/public administration	2,002	6,054,455	9.79%
ONEA	102	92,484	0.15%
Sub-total	266,682	45,386,635	73.38%
Standpipes	2,933	16,466,876	26.62%
Total potable water	269,615	61,853,511	100%

Source: Extract from ONEA 2013 company review, as supplied by key informant

manifested in the activities of the Union for the Protection of the Banks of the Ziga reservoir (Union de Protection des Berges). Union members come from different villages, with a representative of each of the 16 villages around the reservoir (both sides of the lake). The members of the union carry out their function on a voluntary and unremunerated basis, except for a FCFA 10,000 per year allowance for diesel for doing the tours of the lake on their motorised mopeds. The union organises one tour per week, around the lake (both sides). It is sometimes informed of a breach of the rules of use of the reservoir.

Among local people, there was no awareness of the reality that only part (albeit the majority, 85%) of the water conveyed in the main from Ziga to Ouagadougou is destined for drinking and domestic use, as the figures in Table 2 reflect.

The figures of ONEA in Table 2 apply to the medium and large urban centres ⁴³ supplied by ONEA, including Ouagadougou. As shown, a recorded 58.74% of the water invoiced by ONEA goes to connected residential customers, plus a further 26.62% to customers via standpipes, ⁴⁴ making a total of 85.36%, with the other water

supplied to other categories of customer for a range of uses.

In Ouagadougou, the principal commercial/industrial use of water is by tanneries and breweries, as well as in building/construction – for more see Section 4.3.

The leaders of a community near Ziga that specialises in rearing cattle (cows, sheep and goats) visited during the course of this study emphasised the importance of availability of drinking water for cattle as well as people. As Section 1.2 mentioned, livestock is one of the priorities for development in Burkina. If livestock production is to be increased, one of the challenges listed by the SCADD is that of watering places for animals. This particular cattle community is watering animals in the Ziga lake, counter to the expressed instructions of the authorities, who argue that defecation by cattle is a threat to water quality (GoB, 2013). ONEA reports an increasing level of turbidity in the Ziga reservoir (i.e. the water is less clear), ⁴⁵ alongside other water quality concerns – described in Section 4.2.

Meanwhile, the nearby bush/forest provides, the cattle community said, adequate food for the animals, supported by stocking and drying

fodder in raised storage huts and in trees.

What is clear is that the leaders of this village have used access to the Ziga lake to good advantage to build a growing herd. Previously, they had dug wells (down to 10-15 m) for watering the cattle, which was heavy and time-consuming work (both digging and bringing up water). Production is, they say, better now. The benefit that the dam and the lake have brought for local cattle-rearing is clear, although the community faces the possibility that its watering of animals in the Ziga Lake will be prohibited at some time in the future. The community has received no notification of a ban, at least as yet. While the report of the April 2013 workshop refers to ‘more cattle and sheep-rearing around the lake’, the conclusions of the workshop (GoB, 2013) focus on the banning of the irrigation activities (upstream of the dam).

⁴³ ONEA’s responsibility applies to 56 medium and large towns in Burkina.

⁴⁴ This is presuming that the water supplied via standpipes is used for domestic use, as opposed to small commercial use.

⁴⁵ Key informant interview.

3.2 Water – for irrigation

A negative impact of the Ziga dam has been to reduce and limit irrigated agriculture in the area.

The conclusion of the April 2013 workshop – as drawn by the ministry - was that use of the Ziga reservoir for irrigation, including the small irrigation (market gardening) of the type local communities installed beside the lake (i.e. after construction of the dam), is ‘totally incompatible’ with the lake’s drinking water purpose (GoB, 2013). The workshop report refers to the ‘2002 protocol’ between ONEA and the regional environment authority (the Regional Directorate for the Environment and Sustainable Development (DREDD)) and calls on both to take the ‘necessary measures for the removal of the occupants of the banks of the Ziga reservoir’ (GoB, 2013).⁴⁶ This forced removal was then put into effect. The communities upstream of the Ziga dam have thereby been prohibited from access to the water in the Ziga reservoir.⁴⁷ As noted in Section 2.2, the water supply for Ouagadougou provided by Ziga Phase 1 has not taken the extraction of water from the Ziga reservoir to its full capacity. At present (and in the short to medium term), therefore, this is an issue not of competition for the water itself (the physical resource) but of access to the resource to protect water quality (from use of polluting chemicals). Further, AEN was asked to plan for how the banks could be more effectively policed in future.

The ban does not apply to downstream of the Ziga dam, where there are opportunities for

Box 3: Irrigation downstream of the Ziga dam⁴⁸

The women pump water from the river below the Ziga dam and bring it in a 60 mm diameter pipe to a series of concrete outflows at high points in the field from which they can direct irrigation water by gravity. This large field is divided into parcels for different families, marked on the ground with stones or ridging in the earth. The women grow maize in the rainy season (rain-fed) and onions (irrigated) in the dry season. They report a good harvest of onions in 2014, about FCFA 9,000 per parcel (a good income). The irrigation water allows for trees to grow downstream near their homes and on the irrigated fields.

The women would like to extend the area they cultivate. What prevents them is lack of equipment. They would need a big motor pump to bring more water, as well as fencing to protect the larger area from animals (currently, as much as they can, they use spiny/spiky plants in a protective hedge). The pump is an expensive item to buy, as is the diesel to operate it. The smaller pumps cannot handle the pumping for very long – they break down. If the women had support in acquiring a pump and fencing materials, it would not be a problem to use the land available. The support they have received to-date has been confined to one smaller pump paid for by the government, plus from time to time fertiliser from the town hall and a cart also. These families have cows, typically 10-12 per family. The young cows are watered at the home; the women also have an improvised watering point for the cattle downstream of the dam. The men work in agriculture, with fishing as a secondary activity – see Box 4.

irrigation – see Box 3 describing the example of a group of around 200 women who are benefiting from irrigation of an area of approximately 8 ha located some 800 m 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. Before the construction of the dam, the

women collected and sold gravel and aggregates for building. The irrigated agriculture provides them with a better standard of living.

As noted in Box 3, for the women – in their privileged position downstream of the Ziga dam – the limiting factor is not access to water but the need for equipment to use it.⁴⁹

In the Ziga area more widely, a 2011 census recorded 4,089 irrigation plots covering a total of 341.48 ha in the communes of Nagréongo, Absouya and Ziniaré. On these plots, local people (men

⁴⁶ This protocol is cited in the workshop report, without any mention of a law or regulation on which the authority to make such an agreement and carry out the forced removal is based.

⁴⁷ In some countries in West Africa, legal rules exist that prohibit or regulate occupation of the banks or rivers or other surface waters (up to a specified number of metres).

⁴⁸ This must mean the Ziga dam is releasing some water for use by this group of irrigators in the dry season.

⁴⁹ As for domestic water supply, the women access that from public standpipes connected to the reservoir. When asked if they were content with this water access for drinking and domestic uses, they replied that it would be preferable to have water closer and cheaper – the standpipes can be 1 km away from the house, with queuing. As for affordability, the price of their water is FCFA 1 for 20 litres (all year round, including in the dry season). This starts to be significant price when a family uses 200 litres per day – that is, FCFA 100 per day.

and women) were reported to be growing vegetables downstream of the Ziga dam through gravity-fed irrigation mostly, with a few motor pumps in 9% of cases (Traoré, 2013). Local people were also growing banana and papaya trees (ibid.). All such activities upstream of the dam, on both sides of the lake, are banned, as confirmed at the April 2013 workshop. The status of irrigation activities further upstream, north of the Ziga reservoir, is not described in the workshop report.

The impression from the key informant interviews conducted in the Ziga area is of considerable local resentment at this ban. There is a feeling of injustice that the villages adjoining the Ziga lake are not able to carry out productive agricultural activities because – local leaders said – the government had not honoured its commitment to support local people in alternative irrigation projects. The small dams promised by ONEA had – key informants said – not been built, or at least not well built; one dam had been constructed but had collapsed as the earthwork was not strong enough. Alongside the volume of water ONEA plans to extract and convey along the second Ziga-Ouagadougou main, which has been quantified, have local water demands been quantified to assess how far the Ziga reservoir could accommodate (un-polluting) agricultural production as well as urban use?

No figures were available to this preliminary study relating to the funds invested in the Ziga area – the investment in boreholes in local villages, connections (for Ziniaré) and an ill-performing small dam. The investment in Ziga Phase 1 to bring the bulk water to the ‘gates’ of Ouagadougou comprised the

Ziga dam at \$27.64 million, the treatment plant at \$20.51 million and the conveyance mains pipe and interim storage facility at Boudtenga at \$26.83 million, to a total of \$74.98 million.⁵⁰ The question is whether, per capita – that is, allowing for the disparity in the number of users/beneficiaries (the population of Ouagadougou as compared with the population of the Ziga area), the levels of investment are balanced or not. For an answer to this, the comparison would need to be examined in a further phase of study based on more information.

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’.⁵¹ It is especially young people of the communities who are frustrated they cannot make a better living by producing and selling vegetables and other products of irrigation. Many young community members have already migrated away and, among those remaining, there is a grumbling discontent. The impression generally from the focus group discussions and key informant interviews in the Ziga area is that the sense of civic duty demonstrated by local people is being abused. This goes beyond the equities or inequities of water access to issues of equity in allocation of funds for investment in water-related infrastructure. The sense of injustice local people feel is a source of chronic discontent. A local leader commented, ‘Development cannot happen in a context of conflict, without social peace (paix social). As long as we do not receive support/assistance in recognition of the consequences of the dam, there is a problem that needs to be resolved.’ For some

local people, the solution may be to leave the area and migrate to the cities, including the capital, Ouagadougou.

It was striking that local people consistently expressed during the key informant interviews their perception that the timing of the rainy season (onset and duration) was becoming more variable. ‘There is insufficient rain for solely rain-fed agriculture,’ said a local leader.

In terms of funding provided by the government for agricultural programmes, under the National Programme for Agricultural Investment (the PNIA, of September 2009), the major investments are required to align with the SCADD, first and foremost, and then funds are allocated to the sub-programmes set out in the 2011-2015 National Rural Sector Programme (PNRS) (which refers explicitly to the SCADD on its first page). MAHRH aims, it says, to achieve an equitable distribution of investments in different regions (the 13 regions in Burkina), although it acknowledges it is not possible or desirable to commission big projects in every region.⁵² It aims, it says, to support a range of producers – small, medium and large, all of whom it refers to as ‘agricultural entrepreneurs’. That said, a priority of government with donor backing (e.g. from the World Bank) is support to ‘agropoles’, chosen geographical locations where agricultural investment and activity is to be concentrated. The motor of agropoles in semi-arid lands (SALs) is, he said, irrigation. At the location of agropoles, both large and small/medium farmers are

⁵⁰ These figures are the planned allocations of funding to each of the heads/components of Ziga Phase 1, as per the project design (World Bank, 2001), which are subject to the actual disbursement under each head.

⁵¹ A local official echoed this impression by commenting on what he saw as the ‘mentality’ of local people, which was to ‘complain’.

⁵² Key informant interview.

Box 4: Fishing on the Ziga reservoir

The group comprises 10 fishermen in an association called Naaba Wend Panga, formed and approved with a certificate dated 2006. The fishermen each individually have a permit to fish from the lake (the permit costs FCFA 8,000 per year, around \$15.) They acquired the profession of fisherman 'from their fathers'.

The fishing on the Ziga lake is good from March to August, with abundant fish – catches of 40-60 kg per day, with some big individual fish. After that, fishing becomes more difficult, because of more frequent wind, which is troublesome for laying the nets in the water. The fishermen do, however, carry out fishing all the year, to live.

There are a range of species of fish. The native La Capitaine is found much less than before – there has been an effort to restore the population. Meanwhile, new species have come upstream from Bagré and, when ONEA opens the release gates of the Ziga dam, the fish swim past/underneath.

The fishermen have the impression that fish resources in the Ziga lake are under pressure, although not to the extent seen on the lake at Kompienga, where a system of controls of the number of fishers, plus a non-fishing period, has been introduced to allow reproduction and restoring of the fish population. At the time of high water at Ziga, some fishers do come from elsewhere, although not many.

Fishing requires a boat, a pirogue, which they row (to avoid the cost of a motor which is expensive to buy – around FCFA 70,000), plus nets, which are a significant item of expenditure. If they had better equipment, they said, they would be able to catch more fish.

The women work in the processing of the fish catch. People buy the fish at the lake shore.

supported. Examples of agropoles are Sourou and Samedeni.⁵³ The Ziga area is manifestly not an agropole.

3.3 Water – for fishing

In contrast with the ban on irrigation upstream, one clear benefit of the Ziga dam has been the opportunity to fish on the Ziga Lake. The researchers met one fisher group, born and brought up in the local area. These fishermen have in the past migrated to exercise their trade, for example to the Kompienga dam (in the far south-east of Burkina) and to Bagré. Construction of the Ziga dam, however, gave them the opportunity to work as fishermen in their own locality – see Box 4.

The presence of the fisherman confirms that, alongside the principal purpose of the Ziga reservoir as a source of drinking water supply, the authorities permit

a secondary use. 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,⁵⁴ including at different times of the year.

The fishermen commented that the Ziga lake (at the time of the visit by this study) was not filled and the level would drop further as the dry season progressed. The depth of the Ziga lake is, they said, being reduced by sedimentation. Future limits of use of the Ziga reservoir are referred to in Section 5.1.

3.4 Ziga and the equity principle: applied or side-lined?

Ouagadougou's claim for bulk water seems to be asserted by central government as if by right, without consideration of the principle of equity in allocation of water for drinking⁵⁵ between different categories of population as stated in the National Water Policy.

As to an objective assessment of the balance (or otherwise) of equity in the Ouagadougou-Ziga case, there is no simple means of evaluation available to this study. That is, we cannot carry this out without more information enabling a comparison of levels of investment in water infrastructure benefiting the residents of Ouagadougou on the one hand and people in the Ziga area on the other. In aggregate terms, the investment of around

⁵³ 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.

⁵⁴ Representatives of government sometimes referred, during the key informant interviews, to the 'exclusive use' of the Ziga dam/reservoir (à vocation unique), but the presence of fishing points to this as misleading.

⁵⁵ In fact, as noted in Section 3.1, the gaps in water off-takes from the Ziga reservoir for towns on the route of the Ziga-Ouagadougou mains pipe suggest the priority is water for the capital – all uses, including commercial and industrial – rather than just drinking water.

\$75 million in Ziga Phase 1 to bring the bulk water to the gates of Ouagadougou will no doubt dwarf the investment in boreholes in local villages, connections (for Ziniaré) and an ill-performing small dam. The issue, however, is whether, proportionately, allowing for the disparity in the number of users/beneficiaries (the population of Ouagadougou as compared with the population of the Ziga area), levels of investment per capita are balanced or not. For an answer to this, more information would be needed in a further phase of study.

As for the benefits of the Ziga dam for local people, fishing on the lake and irrigation downstream are uses that are currently compatible and complementary with the use of the Ziga reservoir for drinking water. Competition for access to the water in the reservoir is currently about water quality not quantity – the water in the reservoir could at present, and it seems in the medium term, serve the demands of both Ouagadougou and local water users, subject to seasonal variations in flows. As for the potential long-term scenario, this is discussed in Section 4.3. The current clash of interests is between use of the reservoir for drinking water and use of water from the reservoir for irrigation upstream of the Ziga dam. Those uses are seen to be mutually incompatible, at least as the latter has been practised to-date. Local people are aggrieved by what they see as the inequity of government preventing irrigation upstream without providing support to alternative revenue-generating activities.

The principal factor behind the decision to build the water infrastructure in this case is the political power the capital Ouagadougou exerts to attract investment as compared with the relatively weak power of local authorities and communities. As a perverse manifestation of this imbalance, the central authorities

Woman with children in Ziniare, Oubritenga Province, Burkina Faso



Women with children collect water from the Ziga lake, for building
© Peter Newborne/ODI

have made promises to support small investments in water-related infrastructure (the small dams), which have not been met. As for the economic rationality of the Ziga-Ouagadougou rural to urban water transfer, this seems to have been assumed by the political and administrative authorities in Ouagadougou without – as far as the present study has observed – being evaluated.

4. Integration and inclusion

“The impression currently is of institutions working to fulfil their own separate mandate without a vision of the whole. There is a lack of coordination between different parts of government.”

(senior policy specialist)

“The authorities do not really consult us; they tell us what they have already decided.” (local representative)

This section looks – through the Ouagadougou-Ziga and Bagré ‘lenses’ – at the aims of ‘integrated’ water resources management in Burkina as compared with the realities, to-date, in practice, including the extent of inclusion of local people in consultation on planning and decision-making, as well as the likely implications of fast growth of Ouagadougou in the context of climate variability.

4.1 ‘Integration’ and inclusion – policy

As noted in Section 1.1, the goal of the national water strategy is ‘integration’ of water resources management. Integration implies satisfying different demands on water to the extent uses are complementary, and reconciling demands – making trade-offs between them – where they are competing.

MAHRH is the lead ministry responsible for overseeing IWRM in Burkina. Water law, however, provides for a parallel institutional structure of special IWRM institutions based on/adapted from the French system of river basin management (see Box 5).

Box 5: IWRM institutional structure in Burkina

- The **National Water Council** is a high-level consultative body that advises on policy; its members represent all sectors and stakeholders (central and local government, NGOs, etc.).
- The **Technical Committee on Water** is an inter-ministerial committee providing technical advice (e.g. on the drafts of regulations and decrees); it is composed of representatives of a range of ministries whose activities relate to water, including MAHRH, the ministries of environment and energy and the ministries of finance and the regions; all investment projects should go before the Technical Committee on Water.
- The **river basin agencies** (Nakambé, Mouhoun, Cascades, Liptako and Gourma) each have a board, a basin committee and an administrative body.
- **Sub-basin local water committees**, where they are functioning, include representatives of local stakeholders.

As in France, the key planning instruments are, at basin level, the Strategic Basin-Wide Development Plan (SDAGE) and, at sub-basin level, the Sub-Basin Plan (SAGE). Burkina has, as yet, advanced to writing the SDAGE for just two basins (the Mouhoun and Cascades) in 2014. The SDAGE for the Nakambé is at an early information-gathering phase (baseline study).⁵⁶ A local water committee for the Ziga-West area (which includes Ziniaré) exists, but

currently has no funds for its activities.⁵⁷

The national IWRM plan (GoB, 2003, Section 5) notes that the adoption of IWRM in Burkina entails a modernisation and adaptation of the water sector (GoB, 2003). Key informants echoed this, saying implementation of IWRM in Burkina is a process of evolution of mentalities as much as of institutions. Among an older generation of engineers, there is

⁵⁶ Key informant interview.

⁵⁷ The president of the Ziga-West Local Water Committee is an employee of the Ziniaré Town Hall and it is this parallel function within the conventional political-administrative hierarchy that allows him to carry out some functions in relation to local water matters that he would not otherwise be able to fulfil.

scepticism towards IWRM. They still tend to think in terms of ouvrages, built infrastructure (literally ‘works’), championed by individual line ministries. IWRM requires institutional coordination above and beyond sector mandates and interests. IWRM, says the national plan, will ‘privilege the integrated above the sectoral approach’ (ibid.). The plan adds that implementation of IWRM in Burkina ‘will depend essentially on the will and determination of the government to see it through to fruition’, including the ‘capacity of civil servants and officials in public bodies to adopt the IWRM plan of action and put it into effect’ (ibid.).

4.2 ‘Integration’ and inclusion – practice

An issue arises as to how far the principle of ‘integration’ is being applied in Burkina. What does the status of hierarchy of uses of the waters of the Nakambé⁵⁸ reveal as to the role of institutional actors and the decision-making process relating to water infrastructure?

The impression to-date is of a separation of government institutions – DGRE and ONEA, Ministry of Energy and MAHRH – rather than a linked vision, as well as a separation between government institutions and local people. The lack of consultation of local stakeholders in the Ziga area is discussed below. As for the separation between different parts of government, as noted in Section 3.1 ONEA’s mandate is water supply in the medium/large towns of Burkina, whereas MAHRH (DGRE) is responsible for rural villages. In relation to water supply, they represent the two sides of the urban–rural equation and there

seems to be a divide between them. ONEA’s focus is clearly on delivering its mandate as urban water utility. Ziga Phase 2 is managed by the Ouagadougou projects department of ONEA, which focuses on Ouagadougou alone. The ONEA representative interviewed during this study saw ONEA’s path as continuing to achieve an increase in its turnover progressively year by year, as well as maintaining a financial equilibrium. The same ‘silo’ approach seems to apply to the planned new dam called Bagré Aval (‘Bagré Downstream’). The aim of Bagré Aval is to provide hydro-electricity additional to that provided by the existing Bagré dam – to use the water of the Nakambé for hydropower production a second time.⁵⁹ Bagré Aval is at the feasibility stage and the government has already decided to entrust the project file to the Ministry of Energy.⁶⁰

Based on this preliminary study, it is not clear how far, in practice, climate aspects are being taken into account in water and related decision-making in Burkina. The actions set out in the National Action Plan for Climate Change – whose preparation was supported by UNDP, the Global Environment Facility (GEF), the Global Water Partnership and Japanese aid, following on from the National Adaptation Programme of Action (NAPA) – read like a long ‘wish’ list (see Box 6). Many of the recommended steps are doubtless desirable – and resonate with the goals of the PRISE and WISE-UP projects. The question for investigation in a future study would be how far these actions are incorporated into the plans of

sector ministries with government or donor funding available for their implementation.⁶¹

Adoption by ministries of a ‘silo-ed’ approach runs counter to the objective of ‘harmonisation and coordination of action of government and public bodies in the water domain’ (GoB, 2003, Action 7.1 under Institutions). The IWRM institutions do not seem, to-date, to have altered the decision-making process. The conventional political process continues, with the sector ministers in the Council of Ministers/Cabinet putting forward and arguing their case for projects and investments within their sector responsibilities. The powers of the National Water Council are, as noted in Box 3, consultative: it does not have the role of formally approving projects. Nor does it have a power of veto, or a regulatory power, for example to open a procedure of any description where a project is not in conformity with a principle or rule of IWRM. The council does have the right to require a ministry or other body to come before it and present its project.

⁵⁸ As for the Ziga reservoir, the hierarchy of uses is as follows: primary use: drinking water; secondary use: fishing (regulated); irrigation use of water upstream of the dam: prohibited; irrigation use of the water downstream of the dam: regulated. As for Bagré, currently the primary use is hydropower, and the secondary uses are fishing and irrigation. As described in Section 4.4, government officials mentioned the possibility of applying water in the Bagré reservoir as a source of water supply to Ouagadougou during key informant interviews conducted by this study.

⁵⁹ SONABEL will not be the constructor of Bagré Aval; it will take handover once the dam and plant is built, and will operate it. SONABEL did not build the Bagré dam, but was handed it and the power plant to operate.

⁶⁰ Key informant interview.

⁶¹ Also, the current status of the National Action Plan, which was in draft form in April 2014 (GoB, 2014).

Box 6: National planning for adaptation to climate change – recommended actions

Strategic elements stated in the National Action Plan for Climate Change are capacity-building of information systems;⁶² financing measures for climate change adaptation; reduction of the country's vulnerability to climate change; and integration of systematic adaptation into development policies and strategies. Selected extracts from the tables of actions on sectors/themes are as follows:

- **Agriculture:** recovery of degraded lands; capacity-building of farmers; organisation of local markets; promotion of efficient irrigation including the practice of irrigated agriculture outside the normal growing season; development of high-value irrigated crops; and encouragement of entrepreneurship in agriculture in priority sub-sectors.
- **Livestock:** support to resolution of conflicts owing to migration by pastoralists.
- **Water:** mobilisation of surface and ground waters to serve agricultural production, including feasibility studies; construction and restoration of dams, water points and management of low-lying river areas (bas fonds); protection of river banks; construction of new hydro-agricultural dams and valorisation of the potential for irrigation towards optimised management of water; vulnerability of groundwater to climate to be mapped and better monitored; and water demand evolution to be monitored with water savings in all sectors and more reuse of water.
- **Environment:** improved environmental governance; strengthening of the river basin agencies; maintenance of forests; and monitoring of impacts on ecosystems.
- **Energy:** delivery of energy supply despite climate change; strengthening of the transmission lines of the electricity network; public information on energy use; monitoring of use by big energy users; one solar pump for pumping water in each village; one managed forest per village for wood fuel; building of five priority hydropower dams - Bagré Aval, Bon, Bontionli, Foulonzo and Gongourou; and construction of one wind power plant.
- **Urban infrastructure/housing :** access to housing for different social levels; development of towns as part of growth zones; and evacuation of rains through improved storm drainage.

Source: GoB (2014).

⁶² The NAPA funded six weather stations in Burkina to look at the vulnerability of agriculture, environment, livestock, energy, health and infrastructure (thereby doubling existing capacity).

According to key informants, there had been three or four examples of invitations to present to the council (out of some 20 meetings in total to-date of the council).⁶³ There has been one failure to respond to the invitation, by a large agropole project, without it seems the order to attend.⁶⁴ The council meets once a year, sometimes more. ONEA has not as yet presented Ziga Phase 2, although ONEA had been before the council some years ago, in 2004/05 (Ziga Phase 1 predated the creation of the council).⁶⁵ The impression is that the council does not act as a coordinating institutional vehicle for infrastructure options assessment – and is not intended to do so.⁶⁶ As to how the river basin agencies may, each in its own basin, fill the gap, this is discussed below in relation to AEN.

As for natural infrastructure, the key informant interviews suggested a lack of familiarity with the concept, although the support of MAHRH, as noted in Section 2.5, for small water storage tanks using natural materials is an important example of management of natural features of the landscape (low-lying areas) alongside the civil engineering of large projects such as Ziga.

Beyond inter-ministerial collaboration, IWRM is supposed to provide for ‘consensual and participatory management of water resources between a range of stakeholders at different levels with divergent interests and a variety of perspectives’ – that is, going beyond central government to include local authorities and water users (GoB, 2003). The political-economy of water allocation between town and country, as

revealed in the Ouagadougou-Ziga case, is, however, far from, ‘consensual and participatory’, at least currently. The authorities are effectively asserting Ouagadougou’s water claims as of right, without presenting a reasoned case. Reading the report of the April 2013 workshop, it is clear the purpose of the event was not to debate water allocation, but simply to impress on local people the determination of government to halt the ‘secondary uses’ (especially irrigation) that are causing impacts on the water in the Ziga reservoir (GoB, 2013). Among the five presentations on the first day of the workshop, only one person – a sociologist from the Regional Directorate for Agriculture and Food Security – departed from the official line to ask whether it was possible to review and reassess the use of the Ziga dam (GoB, 2013).

The question does not seem to have been addressed. The authors of the report of the workshop refer at the beginning to the search for ‘paths to a solution’, but the conclusion on page 7 is a bald restatement of the position taken by the authorities at the start – namely, that the ‘[drinking water] purpose of the Ziga dam is totally incompatible with agricultural activities’. The ‘deterioration in the quality of the water’ means ‘treatment by ONEA of the water from the Ziga reservoir is becoming more and more onerous, year by year’ and ‘Ziga risks not be able to fulfil its primary function’. The question arises as to the basis for this statement of incompatibility – also what possible opportunity there could be to conduct irrigation differently, in a compatible manner. ONEA reported

to this study that it monitored the quality of the water in the Ziga reservoir according to a range of parameters.⁶⁷ A key concern, says ONEA, is the level of organic pollution in the lake owing to the presence of pesticides (‘organochlorines’). ONEA reports that the benchmark of 4 mg/litre⁶⁸ was exceeded in the first six months of 2014. ONEA emphasises that evolution of such pollutants is not linear, but rather depends on factors such as rainfall including, presumably, the extent of dilution (not just the presence of the irrigation activities themselves).⁶⁹ The situation, ONEA states, is concerning, and the solution is, according to that analysis, to reactivate the existing agreement for the surveillance and protection of the banks of the reservoir by removal of the irrigation activities on the banks (GoB, 2013). There was no mention during this study of the possibility that part (at least) of the pollution in the Nakambé River at Ziga may come from upstream, as a result of the activities of other irrigators, for example.⁷⁰ Further, key informants did not mention the possibility of regulating and controlling the use of polluting substances. The assumption seems to be that local farmers, if allowed to irrigate, would not be responsive to measures proposed for limiting pollution.

As for mitigation of the consequences of the ban on irrigation around Ziga lake, each of the four sessions of break-out groups on the second day of the workshop heard calls for the creation of alternative revenue-generating activities at other locations that could offer potential

⁶³ Key informant interview. Questions relating to the proceedings of council meetings include the following: which institutions and actors commonly choose to actively participate in council meetings? Are the representatives of regions and communes affected by proposed projects also invited to participate?

⁶⁴ Key informant interview.

⁶⁵ Key informant interview.

⁶⁶ Key informant interview.

⁶⁷ Key informant interview.

⁶⁸ This figure or unit looks high. It will be useful to verify this detail in a further phase of research.

⁶⁹ Key informant interview. The cost of treatment includes purchase of chemicals and other materials to neutralise or eliminate the pollutants.

⁷⁰ It could be useful to examine this issue in a further phase of research.

for irrigation (presumably away from the Ziga reservoir itself) (GoB, 2013). Based on the key informant interviews, those calls had not (at least at the time of undertaking this study) been converted into initiatives on the ground supported by government. For example, the proposal that the three small dams be rehabilitated does not seem to have been acted on by the authorities, whether by ONEA as the operator of the Ziga dam or by DGRE.

The manner of handling the April 2013 workshop was a manifestation of Ouagadougou's power. The capital acts as a magnet for investment. The substantial funding for Ziga Phase 2 (around \$208 million), noted in Section 2.3, is to be made available by donors, with the call for tenders already sent out.⁷¹ Stakeholders from the Ziga area, including members of local communities, were invited to attend the April 2013 workshop,⁷² but they were not invited to take part in decision-making. At the workshop, for example, after the formal presentations, there was space for questions from the floor. The report of the workshop provides a short summary of the exchanges in plenary arising from the questions. It is noticeable that, in the summary of these exchanges in the report (occupying a full page), only one point of contention is recorded, namely the 'insufficiency of the small dams at Absouya, Gaskaye and Nagréongo. The inference is that either debate on other controversial points is not reflected in the report or local people did not feel able to express their grievances in front of the 200 persons present. In any event, this was essentially not a process of consultation of

local people. As one local representative commented, 'The authorities do not really consult us; they tell us what they have already decided.'

As for the river basin agencies, their principal role is to provide technical and financial support to initiatives in the relevant basin that advance the 'general interest' in relation to water services and the environment for sustainable management of water resources (GoB, 2003). The question arises as to how the concept of 'general interest' is defined under Burkinabé law,⁷³ and what meaning it is to have in this context, particularly in relation to the concept of 'equitable' access to water for drinking and 'integration' of different demands for water. Meanwhile, 'sustainability' will require addressing of climate challenges: among the actions listed in the national IWRM plan, the river basin agencies are responsible for 'improvement of knowledge on the impact of climate change on water resources' (GoB, 2003).

The area of management of the Nakambé River Basin Agency (AEN) is shown in Figure 6. The office of AEN is located in Ziniaré.

The presentation of the AEN representative at the April 2013 workshop explained the official mandate of the agency and reported on the first steps it had undertaken, including support to resolution of 'use conflicts' at another location in the basin (near Bam).⁷⁴ The workshop report then simply states that the 'present workshop is part of the rationale of AEN's role'. Nothing more, it seems, was said. It is not clear, as yet, how AEN intends to help resolve the use conflicts in and around the Ziga reservoir. At the April 2013 workshop, AEN's

perspective and positioning role was not distinguishable from that of the ministry. As a river basin agency, AEN has its own board and committee, representing the water users in its area. The river basin committee is intended to act as a kind of regional water 'parliament' (at least according to the theory of the French model). The function of a river basin agency is not to behave as if it were an agency of central government. It is going to be important to see how AEN interprets its role, especially as regards representation of the range of stakeholders in the basin.

4.3 Ouagadougou to 2025, and beyond

As for the future perspective of use of the Ziga reservoir, this will depend largely on the future of Ouagadougou and its water demand. The Ministry of Housing and Urban Planning published in 2008 its strategic development plan for Greater Ouagadougou to 2025 – the Schéma Directeur d'Aménagement du Grand Ouaga – Horizon 2025 (SDAGO) (GoB, 2008). This is reproduced here in Figure 7, together with a detailed commentary in Box 7, based on the key to the map in French (legende) as well as consultation with officials at the ministry.⁷⁵

⁷¹ No mention was made of the plan for Ziga Phase 2 including support to alternative irrigation infrastructure.

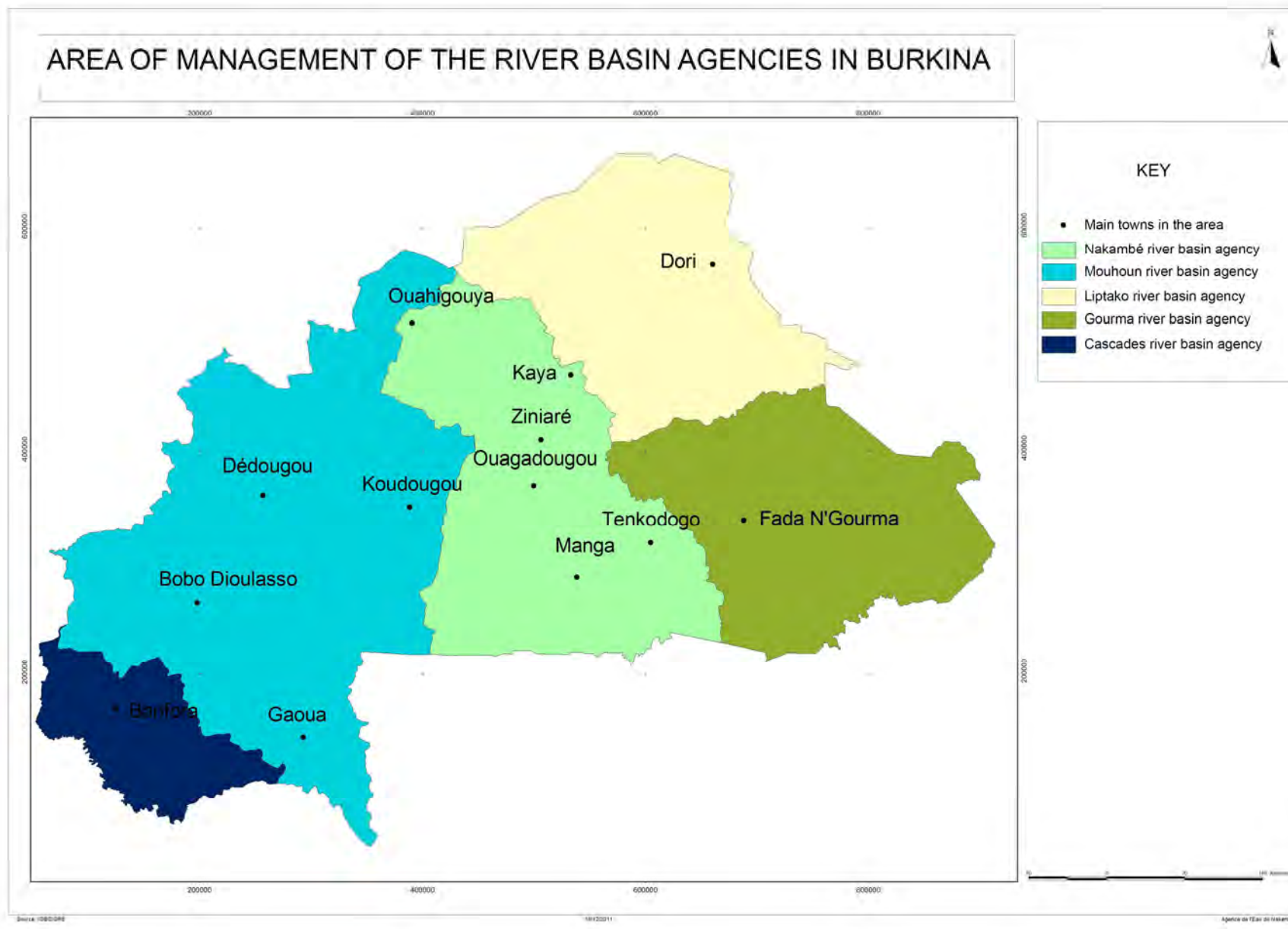
⁷² The list of participants at the workshop is set out in the annex to report of the workshop, on pages 15-22. In total, 219 persons are listed from a wide range of government agencies (at central, regional and local level) with farmers, 'irrigators', livestock-rearers and other local people also attending.

⁷³ French commentators, for example, note the concept of 'general interest' as being broad and vague, at least under the laws of that country.

⁷⁴ Further study could usefully look into this example of conflict resolution by AEN to understand more of its approach and capacity.

⁷⁵ Conducted by the researchers of the Centre for Economic and Social Study, Documentation and Research (CEDRES).

Figure 6: Area of management of the Nakambé River Basin Agency



Source: Geographical Institute of Burkina/Directorate-General for Water Resources

The existing built-up area of Ouagadougou is seen (in grey) in the centre of Figure 7. Around that area, the map shows a band (marked in yellow/beige) of ‘future urbanisation’ (‘zone d’urbanisation future’), forming a concentric circle around the existing built area in all directions except the north-east and south-east. Looking at the map, one observes – based on a rapid appraisal – that this new designated area of future urban development represents between a quarter and one-third of the size of the current city, in territorial terms. In population terms, given the ministry’s plan to adopt a denser model of residential housing (as described in Box 7), this expansion is likely to result in – and be designed to accommodate – growth in Ouagadougou’s population – 1.915 million in 2012 – of a quarter/one-third or more – that is, according to this view, a population of between 2.4 and 2.5 million by 2025. This is substantially lower than the forecast population figure for 2025 noted in Section 2.1, of 3.78 million. A question arises, therefore, as to where the extra million and more city residents forecast at that time will be accommodated, and in what conditions; to what extent the government’s efforts to manage urban growth in Ouagadougou will, or will not, be adequate to meet the actual increase in numbers.

As for the territorial extent of Ouagadougou’s urban development, the intention, as expressed by the ministry,⁷⁶ is that the circular road – marked in dotted red squares on the plan (which will, when completed, form a 360 circle, allowing traffic to by-pass – voie de contournement) – will constitute the definitive outer limit of the city. A further question arises as to whether, in practice, urban development will be confined to

within that perimeter or whether Ouagadougou will expand beyond this. The question is apposite because of what the Ministry of Housing and Urban Planning itself says with regard to gaps in urban planning regulations and capacities, as noted in Box 7. The 2008 National Housing and Urban Development Policy notes that the 2006 Law on Urban Planning and Construction is just the ‘beginning of the legal framework’ (GoB, 2008). Strengthened urban planning rules and capacities are needed, it says, to tackle the ‘major challenge’ posed by real estate speculation, which ‘is common’ (ibid.).⁷⁷

Expressed in another manner, it is not clear in practice how planning control over development in the ‘Greater Ouaga space’ – the large area marked in dotted yellow on the map, located within the ‘green belt’ – will be exercised so as to avoid urban growth beyond the circular road. The implication is that, without ‘evolution of regulation on urban land management’, including ‘clarification of the means by which access to land is obtained’, the speculation will, contrary to the best efforts of the authorities, continue and development will be uncontrolled (GoB, 2008). As noted above, at the forecast rates of fast population growth – 5.97% per year for the period 2015-2020, then 4.95% for 2020-2025 and 4.25% for 2025-2030 – the prospect is of a doubling of the size of Ouagadougou’s population from 2015 to 2030 (to 4.66 million), and a further potential doubling between 2030 and 2050 (to 8.83 million).

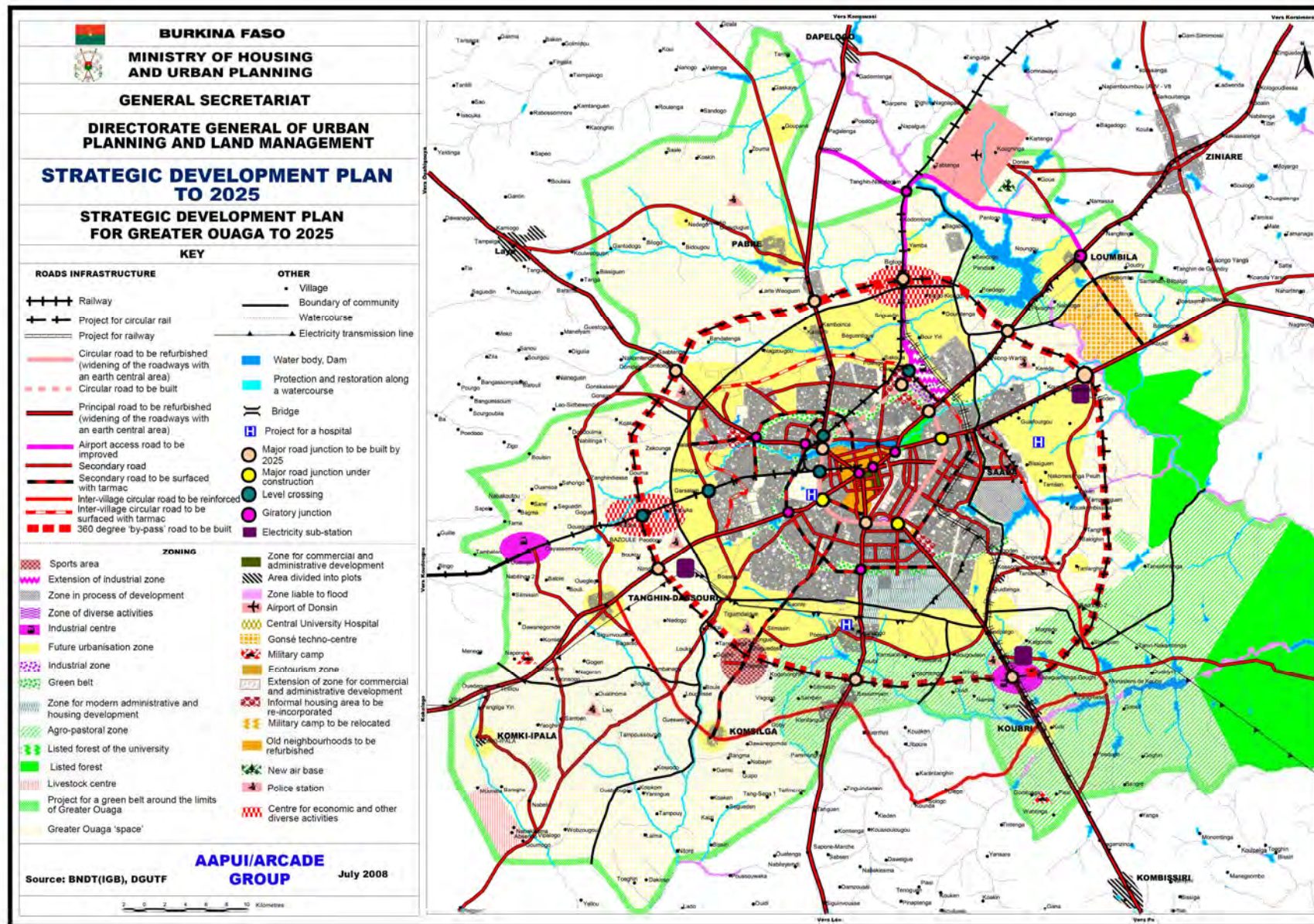
Such a fast rate of city growth suggests there will be (in repeat of the past – see Section 2.1) more unplanned peri-urban areas and more slums lacking basic services, including water. While urban

development plans, such as that set out by the ministry in this case, will seek to enhance the economic dynamic of the city as referred to in Box 1, high inflows of migrants to the capital could give rise to the possibility of negative economic (and social) effects – the diseconomies of scale in Box 1.

⁷⁶ Key informant interview.

⁷⁷ Typically – note the authors of the policy – customary land on the new edge of town becomes the target for purchase in the real estate market.

Figure 7: Strategic Development Plan for Greater Ouagadougou to 2025



Box 7: Strategic Development Plan for Greater Ouagadougou to 2025

Future urbanisation zone

The intention is for the planned residential development in the future urbanisation zone on the ministry's map to include new towns (called *cités relais*) designed to accommodate people at affordable rents, with residents concentrated according to approximately the same income levels. More apartment blocks will be built with multiple floors, thereby placing groups of residents under the 'same roof' (*toit*) instead of each household having a plot of land at ground level (*parcelle*) – that is, a change to a denser model of town planning and living. Such new towns have already been built at Baseko (centre-north-west), Zaktouli (centre-west), Nioko (centre/north-east), Kamboinse (centre-north) and Saaba (east).

Other designated urbanisation areas

Beyond the circular road (marked in dotted red squares), the map shows other future urbanisation areas (also marked in yellow/beige), small in size, around/adjoining each of the existing small towns outside of the city: Pabré to the north, Tanghin-D'Assouri to the west, Komki-Ipala to the south-west, Komsilga and Koubri to the south and Loubila to the north-east.

The green belt

These small towns are all within the Centre region of Burkina, the limits of which are seen on the map in the line of the green belt (*ceinture verte*), marked in green/white hatching on the map. That line follows the shape of the Centre region, as seen in Figure 4. The Strategic Development Plan for Greater Ouagadougou is, in effect, the plan for the whole Centre region.

'Greater Ouaga'

The intention is that the areas within the green belt that are marked in dotted yellow on the map, designated in the key as part of the 'Greater Ouaga space' (*Espace du Grand Ouaga*), will be assigned to other land uses.⁷⁸ The role of the green belt is, according to the ministry,⁷⁹ 'to protect the city by diminishing dust and the effect of wind'; 'to act as space for rest and leisure which will, at the same time, limit the disorganised growth of the city'; 'to provide a green carpet (*tapis vert*) against wind and water erosion especially in relation to the principal dams acting as water reservoirs for the city'; and 'to support agriculture and forestry' (an agro-pastoral zone is marked in hatched green and a forest area is marked in green to the south and south-east/east of the city).

Special planning zones

The circular road will connect special 'industrial zones' to the west near Dayassemnore, to the south near Koubri and to the north-east at Bour Yiri, and an 'economic zone' for 'diverse activities' near Bazoulé in the west (respectively, the oval shapes in hatched purple and hatched red), with also a 'technopole' at Gonsé in the east (in hatched beige).

Future extension of Greater Ouaga

It is noteworthy that the line of the green belt marked on the ministry's plan passes just beyond Boudtenga, a few kilometres from Nagréongo. The Ziga dam is off the map further to the east, but not far from the Greater Ouaga limit, according to this vision to 2025. What will happen beyond that date? Will the green belt take effect to keep Ziga outside the city, or will the Ziga area be absorbed within some future extension of Greater Ouaga – that is, were the green belt not to be applied, or to be redrawn?

⁷⁸ As to current land use in the dotted yellow area, no information was gathered by this preliminary study.

⁷⁹ Key informant interview.

The authors of this national [urban development] policy state:

“If this [urbanisation] process is not managed so as to achieve more of a regional balance, there could be very negative consequences in terms of the physical organisation of space and social equity. Certainly, it will put the two great metropolitan areas [Ouagadougou and Bobo-Dioulasso] under great strain and create environmental tensions manifested by increase in needs for consumption of water and energy (emphasis added).”

As for the positive and negative aspects of urban expansion of Ouagadougou, building and construction is a source of employment in the city, for manual as well as other trades, although the incremental capital output ratio of investment in the sector in Burkina in 2000-2012 was \$3.6 of investment yielding \$1 of GDP, as compared with the global average of \$3.6 of investment yielding \$6 of GDP. This reflects that real estate speculation in Ouagadougou is linked to money laundering (Kouraogo, 2014).

The 2008 urban development policy also notes the need for housing and land use planning to improve in other parts of Burkina, in both rural areas and in/around ‘small towns’, of which there are 36 (GoB, 2008) and the medium-sized towns, of which there are 11 beyond the two ‘metropolitan’ centres of Ouagadougou and Bobo-Dioulasso (GoB, 2008).

In Burkina’s second- and fourth-largest cities, Bobo-Dioulasso and Dédougou, water demand and consumption are rising and ONEA is investing in improvements in water services. In both cities, ONEA is using a combination of its own resources and donor funds (including from the World Bank) to improve water supply. In Bobo-Dioulasso, the aim is to drill three new boreholes (into sedimentary rocks) and build three new water towers to store 4,000 m³ in total. In Dédougou, similarly, there will be new boreholes to retrieve groundwater from the sedimentary geology, with new water towers. These investments should go at least some way towards a regional balance.

What will be the extent of an expanded Ouagadougou in terms of its demands on water resources? Based on the prospect of a doubling of Ouagadougou’s population in the medium term, to 2030, and a further potential doubling of the city’s population in the long term, to 2050, water demand⁸⁰ would exceed the maximum capacity of the Ziga reservoir (according to the average useful volume/active storage of 184.7 million m³) at some time to be determined between the 2030 and 2050 time horizons.⁸¹ The level of unaccounted-for-water in Ouagadougou (i.e. water for which ONEA did not receive payment, because of either physical leaks or failures in invoicing or bill collection) was noted by the World Bank in 2009 to be at 18% of production, which, the World Bank comments, made ONEA’s record one of the best performances in Sub-Saharan Africa.

The current rate of annual growth in urban water demand in Burkina, according to ONEA, is 6%,⁸² above its forecast of 5.45% and substantially above the average rate of national population growth at 3.1%.^{83/84}

4.4 Water – for multiple uses?

As noted in Section 2.4, government officials referred to future growth of water demand in Ouagadougou and mentioned (during key informant interviews) the possibility of using the reservoir of the Bagré dam, some 220 km from Ouagadougou, as a further source of water supply for the capital. No calendar for such an infrastructure project was mentioned, but, based on the prospect of forecast growth

⁸⁰ Assuming similar levels of consumption as currently.

⁸¹ There was no mention during the key informant interviews of a Ziga Phase 3.

⁸² Key informant interview.

⁸³ The ONEA representative spoke of a behavioural element of urban water demand. After connection, the consumption of a client/customer tends to rise, before dropping (‘stabilising’).

⁸⁴ Further study could look at what active steps, if any, ONEA is taking to promote careful/wise use of water in Ouagadougou and other cities/towns.

of Ouagadougou (Section 4.3), the need for such an additional supply would be at some time after 2030.

Currently, the Bagré dam has two purposes, as noted in Section 2.3: hydropower and irrigation – not water supply. Post-2030, however, it is ‘in the minds’ (dans les esprits) of the authorities that Bagré could be the next source (or at least a further source) of water supply to the capital, Ouagadougou.

This is likely, however, to involve choices between different and sometimes competing priorities – that is, trade-offs. The SONABEL records show a great variation in the levels of the Bagré reservoir year by year. The level of filling of the reservoir overall has been greater in the past 10 years than in the previous decade, although with,

recently, considerable variation.⁸⁵ The fluctuations in flows/levels have become more pronounced. For example, in 2011, the reservoir was only partly filled, and 2013 was a dry year also. In 2013, SONABEL stopped hydropower production for a period of two months.⁸⁶ Faced with electricity demand, SONABEL had to administer a programme of power-rationing (load-shedding), for example in Ouagadougou – by ‘rotation’ eight hours per day, by zone. 2006 was also a dry year. In six out of the past 10 years, in contrast, the reservoir filled to capacity and SONABEL had to spill water at Bagré.

In other words, the experience at Bagré corresponds with the national picture, noted in Section 1.2, of increasing variability in precipitation.

The indications are,⁸⁷ in other words, that it cannot be assumed at any given time (at least during dry periods) that Bagré will be able to serve Ouagadougou with both hydroelectric power and water supply in sufficient quantity at the same time. In dry periods, extraction from the Bagré reservoir for drinking water would reduce the amount of water stored for hydropower generation. Article 23 of the 2001 Water Policy Management Act refers to circumstances where ‘drought or other exceptional circumstances do not allow all water needs to be satisfied’ (GoB, 2001). The SDAGE for the Nakambé basin will need to anticipate and analyse the potential trade-offs and set out infrastructure options by way of response.

⁸⁵ The Bagré reservoir empties yearly – there is not an accumulation of water between years.

⁸⁶ How far, if at all, will construction of Bagré Aval change this?

⁸⁷ Further research could usefully examine time series data on river flows and reservoir levels.

5. The urban–rural water interface: preliminary conclusions; suggestions for further research

“For cities/towns, the water management challenge appears to be resolved, though not for rural areas.” (senior government representative)

“One consequence of failure to support rural communities in the development of new irrigation options or other livelihood opportunities may be their abandoning of those communities to migrate to urban areas, thereby increasing water demands in cities/towns.” (policy commentator – international)

5.1 Preliminary conclusions

The Ouagadougou-Ziga case tends to support the proposition that cities are given – or take – priority in water allocation (Komakech et al., 2012; Molle and Berkoff, 2009). In this case, the basis of that prior claim is the political power of Ouagadougou as the seat of central government. The economic rationality of rural to urban water transfers seems to have been assumed without – as far as the present study has observed – being evaluated. Ouagadougou acts as a magnet for financial investment in infrastructure.

The claim of Ouagadougou for bulk water seems to be asserted by central government as if by right without consideration of the principle of equity between different categories of population (including urban and rural) in allocation of water for drinking⁸⁸ stated in the National Water Policy. As to an objective assessment of the balance (or otherwise) of equity in the Ouagadougou-Ziga case, there is no simple evaluation without information enabling a comparison

of per capita levels of investment in water infrastructure benefiting the residents of Ouagadougou on the one hand and people in the Ziga area on the other. For this, more information would be needed in a further phase of study.

Currently, competition for access to the water in the Ziga reservoir is about quality not quantity – the water in the reservoir could serve the demands of both Ouagadougou and local water users. The soon-to-be-built Ziga Phase 2 – a second mains pipe supplying Ouagadougou – will more than double the 40 million m³ that can currently be conveyed to the capital and will do so without exceeding the capacity of the Ziga reservoir. This is based on the ONEA figures, extrapolating a conveyance capacity of Ziga Phase 1 and 2 combined of approximately 100 million m³ per year,⁸⁹ which would leave a margin of 80 million m³ for future capacity growth in the medium term, subject to seasonal variation in river flows. In the long term, however, at forecast rates of population growth, the number of residents of Ouagadougou can be expected to double by 2030 and

then, potentially, double again by 2050. The result would be that the city’s water demand would exceed the maximum capacity of the Ziga reservoir at some time (to be determined) between 2030 and 2050.

For local people, the Ziga project has brought some positive benefits and some negative impacts. Thriving rural communities need water for productive use, yet the villages around the Ziga reservoir are banned by government from irrigating from the lake to protect water quality (from use of polluting substances) and are not receiving support to create alternative revenue-generating activities. They feel this as a significant injustice.

Despite the establishment in Burkina of institutions for ‘integrated’ water resources management, water infrastructure investments still seem to be decided on in sectoral ‘silos’. The conventional political process continues (at least for the moment), with the sector ministers in the Council of Ministers/Cabinet putting forward and arguing their case for projects and investments within

⁸⁸ In fact, as noted in Section 3.1, the gaps in water off-takes from the Ziga reservoir for towns on the route of the Ziga-Ouagadougou mains pipe suggest the priority is water for the capital – all uses, including commercial and industrial – rather than just drinking water.

⁸⁹ It will be useful in a further phase of research to verify these figures.

their sector responsibilities, effectively bypassing the National Water Council. That said, the IWRM institutions are young, with the river basin agencies still working themselves into their roles. They could yet prove to be active promoters of integration, including anticipation and analysis of competing claims on water resources with proposals of infrastructure options as means of managing trade-offs.⁹⁰ This will require, inter alia, listening to the views of local people and taking account of their water needs, to remedy the previous lack of consultation in the Ziga case (noted in Section 4.2). One consequence of failure to support rural communities in the development of new irrigation options or other livelihood opportunities may be their abandoning of those communities to migrate to urban areas, thereby increasing water demands in cities/towns.

Based on this preliminary study, it is not clear how far climate aspects are being taken into account in water-related decision-making in Burkina. According to the climate information available, the pressure on water resources in the Nakambé River is likely to grow with increasing rainfall variability. More access to water storage for irrigation will be essential for maintaining and increasing agricultural production.

There seems to be a lack of familiarity with the concept of 'natural infrastructure' in Burkina, although the use of earth tanks for water storage in low-lying areas using natural materials is an example of it.

5.2 Suggestions for further research

The idea of bringing bulk water to Ouagadougou from the Bagré dam, beyond the horizon of Ziga Phase 2, raises further questions as to the claims of cities versus rural areas in Burkina. The Ministry of Housing and Urban Planning has warned that uncontrolled expansion of urban centres would have serious social consequences and undermine the 'harmonious development of the country' (GoB, 2008,). The question arises: how far would Ouagadougou's continued growth, accompanied by rural to urban water transfers, be desirable for the urban economy and compatible with maintenance of the rural economy?

As noted in Section 1.3, the case of Lake Guiers in Senegal, which provides more than two-thirds of Dakar's water supply, presents an interesting parallel. The facts of Lake Guiers are further described in the Annex. According to one analysis, for some local communities, lack of adequate water supplies has been 'disastrous' and has created tension between groups engaged in different livelihood activities. In recent years, there has also been growing concern as to the deteriorating quality of water in Lake Guiers as a result of commercial agricultural activities, and the rapid spread of water-related disease (schistosomiasis) resulting from the operational regime of the dam. Senegal's Water and Sanitation Policy (Republic of Senegal, 2005) highlighted the management of Lake Guiers as a particular issue of concern, stating that multiple uses – industry, agriculture and drinking water supply – were creating ongoing tensions over the use of the lake's

water, and that the 'highly strategic' water resource is threatened by these major environmental risks. In 2014, the project for Restoration of Ecological and Economic Functions of Lake Guiers was announced, with funding from the government of Senegal, AfDB and GEF. The project aims to improve the water quality of the lake, rehabilitate infrastructure including dykes and drains, restore critical wetlands that support livestock and fishing, bring into production a further 50,000 ha of land for agriculture and provide water supply for 110 villages around the lake, referred to as addressing a 'historic injustice'.⁹¹

In both these cases (Burkina and Senegal), the following questions will be core to a further phase of research:

- On what basis may a clear strategy for allocation of water resources between urban and rural economies and societies in semi-arid areas be determined and substantiated? What is the economic – and social and environmental – rationality for rural to urban water transfers, alongside the political pressures at play? And, related to this,
- How may the processes of decision-making in relation to investment in water infrastructure be improved, so as to choose appropriate options for climate-resilient growth with poverty reduction? According to the PRISE and WISE-UP projects, this will require anticipation and analysis of trade-offs between alternative portfolios of infrastructure – built and natural – with proposed 'multiple' uses (primary and secondary) clearly defined and quantified in each case.

⁹⁰ Alongside the role of IWRM institutions, further study should take into account any relevant investments by the private sector.

⁹¹ AfDB website: <http://www.afdb.org/en/projects-and-operations/project-portfolio/project/p-sn-a00-004/> and <http://www.afdb.org/en/news-and-events/article/afdb-support-to-senegals-efforts-to-protect-lake-guiers-12239/>

References

- AfDB (African Development Bank) (2013a) 'Environmental and Social Assessment Executive Summary – Project to Restore the Ecological and Economic Functions of Lake Guiers'. Project P-SN-A00-004. Tunis: AfDB.
- AfDB (African Development Bank) (2013b) 'Environmental and Social Management Plan Summary – Project to Restore the Ecological and Economic Functions of Lake Guiers'. Project P-SN-A00-004. Tunis: AfDB.
- AGRHYMET (Agriculture, Hydrology, Meteorology) Regional Centre (n.d.) 'Climate Change in the Sahel – a Challenge for Sustainable Development'. Special Monthly Bulletin. Niamey: AGRHYMET Regional Centre.
- Alioune, K.A., Ba, S., Fall, A.N. and Toure, N.F. (2011) 'Pro-Poor Sanitation Solutions: The Case of Dakar', in C. Mafuta, R.K. Formo, C. Nellemann and F. Li (eds) *Green Hills, Clue Cities: An Ecosystems Approach to Water Resources Management for African Cities. A Rapid Response Assessment*. Geneva: UNEP and GRID-Arendal.
- BirdLife International (2015) 'Important Bird Areas Factsheet: Lac de Guiers'. <http://www.birdlife.org>
- Christiaensen, L., Weerdt, J. and Todo, Y. (2013) 'Poverty Reduction During Rural-Urban Transformation'. Working Paper. Washington, DC: World Bank.
- Cogels, F.-X., Coly, A. and Niang, A. (1997) 'Impact of Dam Construction on the Hydrological Regime and Quality of a Sahelian Lake in the Senegal River Basin'. *Regulated Rivers: Research & Management* 13: 27-41.
- Collier, P., Conway, G. and Venables, T. (2008) 'Climate Change in Africa'. *Oxford Review of Economic Policy* 24(2): 337-353.
- FAO (Food and Agricultural Organization) (2010) *Cartographie des zones socio-rurales du Burkina Faso*. Rome: FAO.
- FEWSNET (Famine Early Warning Systems Network) (2012) 'A Climate Trend Analysis of Burkina Faso'. Fact Sheet 2012-3084. Washington, DC: FEWSNET.
- Fujita, M., Krugman, P. and Venables, A.J. (2001) *The Spatial Economy*. Boston, MA: MIT Press.
- GoB (Government of Burkina Faso) (1998) 'Politique Nationale de l'Eau'. Ouagadougou: GoB.
- GoB (Government of Burkina Faso) (2001) 'Loi d'orientation relative à la Gestion de l'Eau (N°002-2001)'. Ouagadougou: GoB.
- GoB (Government of Burkina Faso) (2003) 'Plan d'action pour la gestion intégrée des ressources en eau du Burkina Faso' (PAGIRE). Ouagadougou: MAHRH.
- GoB (Government of Burkina Faso) (2008), 'Politique nationale de l'habitat et du développement urbain'. Ouagadougou: Ministry of Housing and Urban Planning.
- GoB (Government of Burkina Faso) (2011) 'Stratégie de croissance accélérée et de développement durable 2011-2015'. Ouagadougou: Ministry of Economy and Finance.
- GoB (Government of Burkina Faso) (2013) 'Atelier d'échanges sur les problématiques d'utilisation et de gestion durable du barrage de Ziga'. Ouagadougou: Ministry of Water, Hydraulic Infrastructure and Sanitation.
- GoB (Government of Burkina Faso) (2014) 'Plan national d'adaptation aux changements climatiques – Burkina Faso : document de communication pour les décideurs - version provisoire'. Ouagadougou: Ministry of Environment and Sustainable Development.
- GoB (Government of Burkina Faso) (n.d.) 'Analyse des projets, programmes et plans d'actions en cours' (selon retraitement des données du répertoire des projets 2006). Ouagadougou: MAHRH.
- Guengant, J.P. (2011) 'Comment bénéficier du dividende démographique ? La démographie au centre des trajectoires de développement dans les pays de l'UEMOA : Analyse pays Burkina Faso'. Study published by AFD for the Conference « Population, développement et planification familiale en Afrique de l'Ouest francophone : l'urgence d'agir », Ouagadougou, 8-11 February.
- Hartwig, R. (forthcoming, 2015) 'Perceptions on Climate Variability, Households' Current Exposure to Shocks and Coping in Semi-Arid Lands: A Case Study from the Central Plateau region in Burkina Faso'. Report for PRISE.
- ICI (Initiatives, Conseil International) (2010) 'Etat des lieux autour du barrage de Bagré au Burkina Faso'. Final report for IUCN and IIED.
- INSD (National Demographic and Statistics Institute) (2008) 'Recensement général de la population et l'habitation de 2006'. Ouagadougou: INSD.
- INSD (National Demographic and Statistics Institute) (2011) 'La région du centre – en chiffres'. Ouagadougou: INSD.
- INSD (National Demographic and Statistics Institute) (2012) 'Enquête démographique et de santé et à indicateurs multiples, 2010'. Ouagadougou: INSD.

- IUCN (2014), 'Water infrastructure – examples', slide presented to and discussed at Annual Partners' meeting of the WISE-UP to Climate project, IUCN HQ, Gland, Switzerland, 15th-17th October, 2014
- Komakech, H.C., van der Zaag, P. and van Koppen, B. (2012) 'The Last Will Be First: Water Transfers from Agriculture to Cities in the Pangani Basin, Tanzania'. *Water Alternatives* 5(3): 700-720.
- Kouraogo, H. (2014) 'Burkina Faso, Profil 2012'. Presentation for UPS and UNDP.
- Jones, L., Carabine, E., Roux, J.P. and Tanner, T. (2015) 'Promoting the Use of Climate Information to Achieve Long-Term Development Objectives in Sub-Saharan Africa: Results from the Future Climate For Africa Scoping Phase'. Report for CDKN.
- Lucci, P. (2014) 'An Urban Dimension in a New Set of Development Goals'. Working Paper. London: ODI.
- Molle, F. and Berkoff, J. (2006) 'Cities vs. Agriculture: Revisiting Intersectoral Water Transfers, Potential Gains and Conflicts'. Research Report 10. Colombo: Comprehensive Assessment of Water Management in Agriculture, IWMI.
- Molle, F. and Berkoff, J. (2009) 'Cities vs. Agriculture: A Review of Intersectoral Water Re-allocation'. *Natural Resources Forum* 33: 6-18.
- Nebié, B. (n.d.) 'Plan gouvernemental d'atténuation des impacts sur l'environnement du projet AEP de la ville de Ouagadougou à partir du barrage de Ziga : évaluation des prescriptions environnementales relatives à la conservation et à la protection de la biodiversité'. Ouagadougou: ABUCOME.
- Newborne, P. (2010) 'Pipes and People: Progress in Water Supply in Burkina Faso's Cities: Progress of a Corporatised Water Utility'. Development Progress Study. London: ODI.
- Newborne, P., Tucker, J. and Bayliss, K. (2010) 'Strengthening Pro-Poor Targeting of Investments by African Utilities in Urban Water and Sanitation – the Role of the International Development Association of the World Bank'. Report on case studies from Burkina Faso, Ghana and Tanzania. London: ODI
- OMVS (Senegal River Basin Authority) (2003) 'Senegal River Basin: Guinea, Mali, Mauritania, Senegal'. Case Study in the First World Water Development Report. Paris: UNESCO.
- ONEA (National Office for Water and Sanitation) (2013) 'Presentation du barrage de Ziga et rappel sur son contexte de réalisation'. Workshop on « Problématiques d'utilisation et de gestion durable du barrage de Ziga » , Ouagadougou, 11 April.
- Republic of Senegal (2005) 'Lettre de politique sectorielle de l'hydraulique et de l'assainissement en milieu urbain et rural'. Dakar: Republic of Senegal.
- SE4ALL (2013) 'Sustainable Energy for All: Global Tracking Framework'. Washington, DC: World Bank.
- Tigasse, A. (2014) 'Analyse des projets, programmes et plan d'actions en cours selon retraitement des données du répertoire des projets 2006 de la DEP'. Ouagadougou: MAHRH.
- Traoré, D.O. (2013) 'Etat des lieux des Activités Agricoles autour du Barrage de Ziga'. Workshop on « Les problématiques d'utilisation et de gestion durable du barrage de Ziga », Ouagadougou, 11 April.
- UNDP (UN Development Programme) (2006) *Beyond Scarcity: Power, Poverty and the Global Water Crisis*. Human Development Report 2006. New York: UNDP.
- UN Population Division (2014) 'World Urbanization Prospects: The 2014 Revision. File 14: Average Annual Rate of Change of Urban Agglomerations with 300,000 in Habitants or More in 2014, 1950-2030 (in Percentages)'. New York: Department of Economic and Social Affairs, UN Population Division.
- Varis, O. and Fraboulet-Jussila, S. (2002) 'Water Resources Development in the Lower Senegal River Basin: Conflicting Interests, Environmental Concerns and Policy Options'. *Water Resources Development* 18(2): 245-260.
- Wetta, C. and Fofana, D. (2010) 'Renforcer l'inclusion des populations et quartiers pauvres dans les investissements en AEPA dans les contextes urbains – projets en Afrique subsaharienne soutenus par 'IDA', de la Banque Mondiale'. Ouagadougou: University of Ouaga II.
- Wetta, C., Dpama, J.-M., Akouwerabou, D. and Sampana, L. (2015 forthcoming) 'Changement climatique et contexte socio-economique national au Burkina Faso'. IED and IRCAA for PRISE.
- WHO (World Health Organization) and UNICEF (UN Children's Fund) (2014) 'Progress on Drinking Water and Sanitation – 2014 Update'. Geneva: WHO and UNICEF.
- World Bank (2001) 'Project Appraisal Document for the Ouagadougou Water Supply Project (Ziga Phase 1), P000306, February 2001, Approved by the World Bank for International Development Association (IDA) Funding in 2001'. Report 201454-BUR. Washington, DC: World Bank.
- World Bank (2009) 'Project Appraisal Document for the Urban Water Sector Project (P106969) Approved by the World Bank for International Development Association (IDA) Funding in 2009'. Report 47392-BF. Washington, DC: World Bank.
- World Bank (2014) 'Project Paper on a Proposed Additional Grant (of

USD 80 Million Equivalent) to
Burkina Faso for the Urban Water
Sector Project (Project No:
P149556) – PAD 958'. Washington,
DC: World Bank.

Annex: Lake Guiers, Senegal – a case of multiple use?

Lake Guiers is Senegal's only large freshwater lake, lying in the semi-arid north of the country and fed by the Senegal River via the Taoué Canal. At high water, the lake covers almost 17,000 ha, being 35 km long and 7.5 km wide at its widest point, and supports a variety of local livelihoods as well as wildlife (Birdlife International, 2015). It is the major water source for the capital city Dakar and its environs, as well as the source for large-scale irrigation schemes in the semi-arid zone surrounding the lake itself. Although the lake is some 160 km from Dakar, it has supplied a growing proportion of the city's water since the 1980s. In particular, after the decision to reduce withdrawals from boreholes owing to fears of saltwater intrusion, Lake Guiers supplied 22% of the city's water in 2004, and 75% in 2009 (Alioune et al., 2011). The city's total water consumption was estimated at 286,000 m³ per day in 2008 (meaning withdrawals of about 214,500 m³ per day and over 78 million m³ annually from Lake Guiers at that time), and is projected to reach 346,000 m³ by 2020. It has proved difficult to find any estimate of irrigation withdrawals from the lake in recent years, but in 1988 irrigation withdrawals were reported to be 285 million m³ per year (World Lake Database)⁹².

Thirty years ago, both the quantity and the quality of water in the lake were highly seasonal. It was filled each flood season from the Senegal River, and declined dramatically in volume by the end of the dry season. On top of natural

seasonal variations, the irrigation of 8,000 ha of sugar cane and 1,500 ha of rice decreased dry season water levels. Peak volumes of 5-600 million m³ in the wet season fell tenfold to 50-70 million m³ by the end of the dry season (Birdlife International, 2015), and in some years the lake ran almost dry (Cogels et al., 1997). With water levels so low, downstream flows in the river connecting the lake to the sea substantially declined, and seawater frequently travelled upstream into the lake, causing it to become saline in the dry season. Salinity would become highest in the southern section of the lake, closest to the sea, with upper parts of the lake progressively fresher (Birdlife International, 2015; Varis and Fraboulet-Jussila, 2002).

Local communities also practised flood recession agriculture, utilising the lake's varying water levels, and engaged in fishing and livestock-herding. The shores of the lake were, and still are, home to a wide variety of ethnic groups, each engaged in its own distinct, traditional range of livelihood activities based on a complex and hierarchical system of access to land and water in wet and dry seasons (Varis and Fraboulet-Jussila, 2002).

The highly seasonal availability and quality of water in the lake made it of limited use as a reliable water supply source for urban water supply whose water needs are year-round, as well as for the larger irrigation schemes envisaged by governments, which require water primarily in the dry season. During the 1970s, various outlets from the

lake were closed off in order to retain more water in the lake. This also had the effect of cutting off flow to some surrounding wetlands, affecting their ecological status (AfDB, 2013a).

In 1986, the Diama dam was constructed on the river downstream of Lake Guiers in order to stabilise lake levels, by limiting outflows from the lake, and to prevent saline intrusion from the sea. The primary goal was to enable significant irrigation development, following devastating droughts in the 1970s that caused thousands of rural dwellers to flee to cities.

The Diama dam has brought major consequences for the lake and surrounding areas. Since its construction, water levels in the lake have been kept high, and the lake has remained fresh. This has enabled the lake to be developed as the major water source for Dakar, with a pumping station and treatment plant established on site, and permitted the expansion of sugar cane plantations north of the lake, as well as other large-scale irrigated cash crop production. These sugar plantations are owned by expatriates (at least at the time of the last available study, 2002), employing 8,000 people and generating 15% of the region's gross local product (Varis and Fraboulet-Jussila, 2002). Since 2001, the Manantali hydropower dam upstream on the Senegal River (located in Mali but jointly owned by all four members of the Senegal River Basin Authority (OMVS) has further regulated flows into the lake.

⁹² World Lake Database: excel file supplied at: <http://wldb.ilec.or.jp/LakeDB2/Data.asp?LakeID=AFR-09&DataID=7070&RoutePm=0%3A%3B6%3Aload%3B7%3Aload%3B1%3ALakeID%3DAFR-09%3B2%3ALakeID%3DAFR-09%3B>

The priority accorded to national development goals in terms of irrigation, associated agro-industrial development and urban water supply for the capital has brought negative impacts at the local level for the residents of the lakeshores. Flood recession agriculture can no longer be practised. According to Cogels et al. (1997), this ‘forced abandonment’ has been ‘disastrous’ for some. Some farmers switched to irrigated production of rice and tomatoes, but only a few were able to turn this into a profitable venture and many fell into debt and bankruptcy, receiving little support from authorities, who were focused on large-scale irrigated agriculture (ibid.). Varis and Fraboulet-Jussila (2002) also report that small-scale irrigation to produce food for local use has been unsupported and that – at least at that time – local agricultural production was barely sufficient to support the population. Traditional regimes governing seasonal access to land and water for farmers, fishers and herders have been completely disrupted by the shift to a stable lake level. Varis and Fraboulet-Jussila also refer to the ‘restrict[ion of] local irrigated agriculture’ in recent years in order to protect irrigation and urban supply, but give no further details. In some cases this has resulted in tensions between the ethnic groups, since some livelihood practices have been advantaged and others disadvantaged.

Owing to the absence of natural periods of drying and salinity, as well as nutrient pollution from plantations, the lake has now become overgrown with large aquatic plants that have blocked water off-takes, caused eutrophication and hindered local use of the water. These plants have also provided breeding grounds for snails, which has allowed intestinal schistosomiasis – previously unknown in these communities – to establish and become endemic. One study found 72% of the local population was infested (OMVS,

2003). Water quality is also being degraded by agricultural runoff and agro-industrial wastes, as well as mining residues from upstream: pesticide and heavy metal levels are increasing (Varis and Fraboulet-Jussila, 2002; OMVS, 2003). Meanwhile, villages around the lake have not been provided with drinking water supply systems and continue to rely on untreated lake water. Their populations have also been increasing rapidly, and faster than those of surrounding regions, trebling between 1975 and the turn of the millennium (Varis and Fraboulet-Jussila, 2002).

There are also reports that the Ferlo Valley, lying at the south end of the lake, once a cattle-herding area inhabited by nomads, has been ‘sacrificed’ to the national development goals that lake management has served for the past 30 years. In order to control water levels in the lake, it is reported that the valley has served as a ‘dumping ground’ for excess water flowing from the southern part of the lake. As the valley itself has no outlet for water, only evaporation, there has been a progressive build-up of salts and pollutants, which (commentators argue) have made water quality progressively worse. While some herders continue to breed cattle, their livelihoods are deteriorating. ‘The Ferlo Valley pays the price for keeping Lake Guiers as a freshwater body’ (Varis and Fraboulet-Jussila, 2002).

The extent of environmental degradation, the threat of invasive plants and the high level of water-related diseases caused growing concern about the management of Lake Guiers at national level. Senegal’s Water and Sanitation Policy (Republic of Senegal, 2005) highlighted the management of Lake Guiers as a particular issue of concern, stating that multiple uses – industry, agriculture and drinking water supply – were creating ongoing tensions over the use of the lake’s water, and that this

‘highly strategic’ water resource was threatened by these major environmental risks. The policy noted that IWRM was officially introduced in Senegal in 2003, and establishing a management regime for Lake Guiers was to be one of the primary objectives of IWRM in the country. The fact that two of the three top management priorities identified in the policy relate to safeguarding water supply for Dakar (the second of these being to provide alternative water resources for market-gardeners in Niayes, a peri-urban area, who are said to be using too much water from the piped supply for irrigation purposes), indicates a high priority attached to urban water provision.

In 2014, the project Restoration of Ecological and Economic Functions of Lake Guiers was announced, with funding from the Senegal government, AfDB and GEF. Running to 2018, the project aims to improve water quality, facilitate storage of more water in the lake to meet various needs (including water supply for Dakar), revitalise wetland ecosystems around the lake, rehabilitate infrastructure, restore dykes and drains, develop management tools, provide water supply for 110 villages around the lake (which it refers to as addressing a ‘historic injustice’), promote fisheries and irrigate a further 30,000 ha (AfDB, 2013a; 2013b). The goal of the project is to boost production in agriculture, restore critical wetlands that support local livelihoods in livestock and fishing and provide climate adaptation benefits by considering climate risks such as exceptional flows and droughts. Sluices will, for example, be put in place to allow water levels in some wetlands to be controlled if needed to prevent floods (ibid.). The project will also remove invasive plants and refill waterways to allow greater access to water bodies, with a view to improving livelihoods and reducing conflict among communities, as well as building the capacity of grassroots organisations and

piloting youth employment initiatives such as in rural tourism and fish farming (ibid.). The Ndiael Wildlife Reserve will be developed and refilled with a view to possible tourism opportunities. For rangeland restoration, deferred grazing will be implemented on 1,000 ha of land. Six livestock watering points and 166 sanitation facilities will be built along with the water supply network (AfDB, 2013b).

The Environmental and Social Plan for the project also notes that 'the presence of water close to arable land is already arousing the interest of private investors who, alongside smallholders, are planning to turn the area into another special zone for the development of export and industrial crops using environment-friendly techniques' (AfDB, 2013b). It is not clear how environmentally friendly techniques will be promoted, and how the problem of eutrophication and contamination of the lake with pesticides, fertilisers and heavy metals will be addressed. Nor is it clear what measures, if any, will be put in place to control the environmental impact of existing large plantations and sugar processing industries. Project documents refer to a Lake Guiers Management Plan as the basis for the project, although this does not appear to be available online. Overall, however, the project takes an ecosystem-based approach to management. For example, developing the lake's former outlets will allow freer water circulation, preventing the growth of aquatic plants and improving water quality. The project is expected to benefit wildlife including various rare species and migratory birds (ibid).

Cogels et al. (1997) argued it would be possible to operate the Manantali and in particular the Diama dam to restore a certain amount of seasonal variation to lake levels without sacrificing supply for irrigation or urban supply (at least at that time, they reported that only 15-18% of the lake volume was

being withdrawn and that levels were kept higher than necessary), which could make flood recession agriculture possible again, dry up some of the excess aquatic vegetation and help tackle schistosomiasis. Varis and Fraboulet-Jussila (2002) note that this possibility has been discussed ever since the construction of the dams, but not implemented.

Meanwhile, Dakar is again facing water shortages and in 2014 the Senegalese water utility (SDE) announced plans to construct a desalination plant with 100,000 m³ daily production capacity with financing from the Japan International Cooperation Agency. It is not clear what effect this will have on water demands from Lake Guiers.

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