



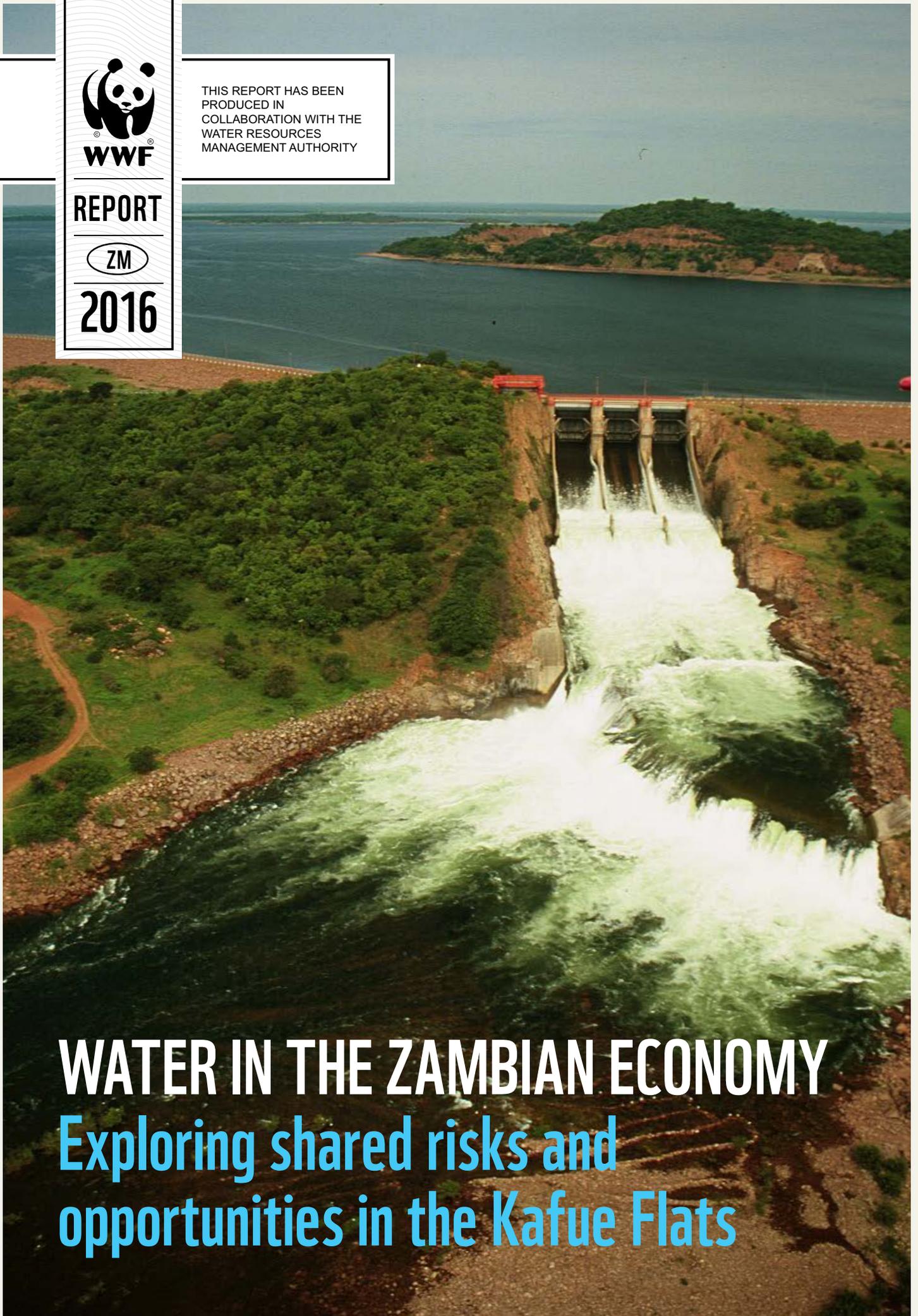
WWF

REPORT

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WATER IN THE ZAMBIAN ECONOMY

Exploring shared risks and opportunities in the Kafue Flats

2nd edition

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WWF's mission is to stop the degradation of the planet's
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live in harmony with nature, by: conserving the world's
biological diversity, ensuring that the use of renewable natural
resources is sustainable, and promoting the reduction of
pollution and wasteful consumption.

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FOREWORD

“Water is inextricably linked to the development of all societies.”

Water is inextricably linked to the development of all societies and flows through the three pillars of sustainable development – economic, social and environment. Water resources provide essential services that are among the keys to achieving poverty reduction, inclusive growth, public health, food security, dignified lives for all and long-lasting harmony with the planet’s essential ecosystems. Water is becoming increasingly scarce; the World Economic Forum ranks the water supply crisis as one of the top three global risks.

Water issues in Zambia have risen in prominence in recent years. This reflects a growing understanding of water’s centrality in the country’s economic growth, which has stood at an annual average of 6 per cent for the last decade. However, this development also places significant pressure on water resources – agriculture, energy, and industrial and domestic water supply all have impacts on the use and governance of water.

This report commissioned by WWF-Zambia comes at a critical time, when freshwater resources in Zambia face rising pressure to provide for the social, economic and environmental needs of a growing population. The report illustrates the role water plays in the economy of Zambia, with a specific focus on the Kafue Flats – the lifeline of Zambia’s economy. With a broad and ambitious scope, the report provides a thorough understanding of the interconnectedness of all users to a functioning ecosystem and the pertinent risks and opportunities within the Kafue Flats.

It is important to recognize that the decisions that determine how water resources are used are not made by water managers alone but by all stakeholders through concrete actions that include establishing the legal and institutional framework to ensure sustainable water management. To these ends, the Water Resources Management Authority (WARMA), an institution mandated by the Zambian government through the Water Resources Management Act No. 21 of 2011 to manage all water resources in Zambia, is deeply committed to ensuring sustainable utilization of shared water resources through collective action. It encourages companies to become much more than just water users, but advocates for better water management; the root cause of water risks is often not the availability or use of water, but its governance. Unless a catchment is governed in a sustainable way, one company’s improved efficiency will likely be overshadowed by increased water usage by a competitor or neighboring community.

This report is a must-read to understand the role that water plays in the development of Zambia and it is our hope that it can inspire strategies, policies and collective action for years to come. It is our appeal to government leaders, civil society and the private sector to join hands and protect our most valued resource, and ensure a more sustainable future for all



Paul Kapotwe
Director General
Water Resources Management Authority (WARMA)

EXECUTIVE SUMMARY

This report considers the importance of water in the economy of Zambia, with a specific focus on the wetlands of the Kafue Flats. By examining the role this key area of natural water capital plays in various aspects of the economy, the report demonstrates Zambia's critical dependence on water for both economic and social development. In order to sustain economic growth and the resultant socioeconomic benefits for the country as a whole, necessary action needs to be taken to more appropriately and sustainably manage water resources in Zambia.

For business in particular, there is great interest in the way water resources are managed, both because of the risks the private sector faces, but also because of the inherent opportunities for innovation and partnership. There is great potential for collective action and stewardship between the private and public sectors, as well as opportunities to experiment with new coalitions and become an example of effective public-private collaboration for other parts of the country. With various actors in the private sector already expressing their interest and enthusiasm for water management collaboration, as well as their eagerness to continue engaging on the subject and driving the process forward, the current climate for collective action is very positive.

By highlighting a selection of pertinent risks and opportunities within the Kafue Flats, the report demonstrates that it is crucial for both the private and public sectors to become more engaged in sustainable water management. These risks include water use and abstraction allocations, as well as water quality or climate change impacts, and are investigated through four core narratives that highlight the systemic nature of risks within a catchment context.

The Water Resources Management Authority (WARMA), as the institution mandated to manage all water resources in Zambia, and WWF-Zambia undertook this water risks and opportunities study. This report is targeted toward all stakeholders within the Kafue Flats who have an interest in its optimal functioning, including government ministries such as agriculture, energy and environment, in addition to private sector companies that have their business or supply chains in the catchment. Civil society organizations in the region may also find the report insightful in understanding the interconnectedness of all the users within the Kafue Flats in terms of maintaining a functioning ecosystem.

It is our hope and expectation that the Water Resources Management Authority, WWF-Zambia and other river basin organizations will eventually upscale water resource management efforts to other basins and catchments within the country. However this report is not just relevant for Zambia. It provides an informative case study for companies, governments and water stakeholders across the globe. It demonstrates that by looking at water through an economic lens a whole new set of questions about how a river is managed will need to be explored. It is also our hope that this approach will lead to a better understanding of the shared water challenges and opportunities and the need for good water governance extending far beyond Zambia and the Kafue Flats.

“It is crucial for both the private and public sectors to become more engaged in sustainable water management.”

FOUR KEY RISK NARRATIVES

Through a number of stakeholder engagement processes and a literature review of water and the economy of the Kafue Flats, the following four key narratives have been identified:

1. Livelihoods and tourism depend on a healthy ecological system

The Kafue Flats are home to 9 per cent of the Zambian population. A large proportion of this population (73 per cent) is rural, and directly dependent on the ecological function and flow regime of the flats. Their livelihoods are supported primarily through smallholder maize production, cattle rearing and fisheries. Each of these sectors has distinct ecological and hydrological requirements.

Tourism in the Kafue Flats is also fundamentally dependent on the flow regime through the biodiversity and ecological processes that the variable hydrology supports. This is especially pertinent due to the sensitive ecosystems and natural reserves, and the Game Management Areas including Lochinvar National Park and Blue Lagoon National Park, which are Ramsar sites. According to the World Bank, tourism represents between 6 and 10 per cent of the Zambian economy. With their proximity to Lusaka, the Kafue Flats are likely to represent a significant portion of this GDP contribution.

2. The food and beverage industry is dependent on a number of inputs from the Kafue Flats

Agriculture represents 73 per cent of water withdrawal in Zambia. The majority of the withdrawals take place within the Kafue Flats, where large tracts of sugar cane are irrigated. In addition to sugar, the Kafue Flats are home to the largest concentration of cattle in Zambia, the largest area of maize planted (mostly by smallholders), and barley. Some small but growing floriculture and horticulture industries are also based in the sub-catchment, while companies such as Zambeef Products Plc, Zambian Breweries Plc, Parmalat Zambia Ltd and The Coca-Cola Company source large proportions of their inputs from the region. The agricultural and agro-processing sector offers significant opportunities for Zambia if cultivated and expanded further. These include supporting smallholder farmers and increasing the country's food security while creating additional employment.

3. Hydropower dependency is completely intertwined with the Kafue Flats, with mining a major receiver of electricity

As hydropower represents 90 per cent of all electricity produced in Zambia, the stability of the water supply to drive the turbines is of paramount importance to the country. The Kafue Gorge Dam produces 990 MW of power for the grid in Zambia, representing 50 per cent of power production' and therefore approximately 45 per cent of Zambia's electricity generation. In an effort to secure a stable water supply, two dams have been constructed in the Kafue Flats. The Itezhi-Tezhi reservoir 250kms upstream of the Kafue Gorge acts as the main water storage system, supplying water to the Kafue Gorge to generate power. Water released from Itezhi-Tezhi is needed at a particular volume to ensure power generation is optimized in the gorge. The operating rules of the dam have been updated to include a flow regime that supports improved ecological functioning. However, it is believed that there is still scope for further improvement of the rules.

The mines are the major consumers of electricity accounting for 68 per cent, followed by households, which use 19 per cent. The embedded water of hydropower links the mines into the Kafue Flats. As a result, they too have a vested interest in ensuring optimal water resources management of the Kafue Flats.

Zambia has a low electrification rate. Currently, the majority of energy used in Zambia is biomass through wood or charcoal. These activities have detrimental effects on the environment in Zambia. One side-effect of deforestation is increased siltation in the Kafue Flats, which in turn negatively affects hydropower generation. Therefore, it is necessary to increase access to electricity in addition to increasing the generation capacity.

4. Lusaka draws food, energy and water from the Kafue Flats

Lusaka is the capital and largest city of Zambia, as well as its chief administrative, financial and commercial centre. Situated within the Kafue basin, the city is dependent on an offtake pipe from the Kafue Flats for 44 per cent of its water supply. Domestic demand is projected to grow considerably, putting further pressure on surface water abstraction from the Kafue Flats. In addition, a large amount of water is lost and wasted through more than 50 per cent of non-revenue water and losses. It is assumed that the majority of the losses stem through the substantial pipeline transporting water from the Kafue River to Lusaka.

The food and energy needs of Lusaka's population are also mostly sourced from the Kafue Flats. Electricity is generated through the Kafue Gorge Dam, while food staples such as maize, beef, fish, milk and sugar are mostly sourced from the Kafue Flats region.

STAKEHOLDERS TO DRIVE COLLECTIVE ACTION AND STEWARDSHIP

Since the domestic market in Zambia is largely dependent on production from the Kafue Flats, one of the major stakeholders with an interest in the region is the Ministry of Finance and National Planning. With water being so critically important to ensuring the future economic prosperity of Zambia, it is necessary for the ministry to become actively engaged in water resource management by driving a stakeholder-focused integrated water resource planning exercise.

The Kafue Flats situation is unique as it brings together ministries and departments involved in energy generation, agriculture, water supply and sanitation, livelihoods, tourism and environment. Institutional arrangements within the Kafue River basin are complex due to the array of sectors and institutions involved in different aspects of the economy. There are a number of institutions responsible and involved in each of these risk narratives.

Therefore, the role and function of natural capital, including disproportionately important areas like the wetlands of the Kafue Flats, must be factored into growth plans. If planning fails to do so, not only will the economy be affected, but human well-being will decline and environmental values lost. Sector planning and water allocation must not be done in isolation. Water allocation optimization is critical to in turn optimize economic development. Water use maximization for any given sector will have negative impacts on the overall economy of Zambia.

In addition to the public interest of the Kafue Flats for Zambia, the region is also of importance for foreign earnings through export. Private sector stakeholders with a specific interest in the Kafue Flats range from those with direct operations in the area to those with their supply chains located there.

In light of an often under-resourced public sector and the significant private sector business linkages into the catchment, there are substantial shared risks that can arise if water is not managed adequately.

In managing the competing water needs and risks within the Kafue Flats, alongside meeting the goals for the Sixth National Development Plan, a partnership between the private and public sector will be critical to ensuring that infrastructure development, economic diversification and rural investments are sustainable both economically and socially.

Partnerships between the public and private sector with regards to water resources have become more common globally, and are increasingly contributing to responsible, sustainable management of freshwater resources by looking outside of individual water use statistics and considering the broader system of the catchment where they are based. This follows the recognition that water risks cannot be managed by a single institution alone, but instead requires collective action from a range of actors. Collective action can be defined as coordinated action taken together by multiple parties to achieve common water objectives while providing shared benefits. This we call water stewardship.

PROPOSED ACTION PLAN FOR IMPROVED WATER RESOURCES MANAGEMENT IN THE KAFUE FLATS

The government of Zambia is encouraged to join forces with both the private sector and civil society to take the necessary steps towards ensuring sustainable water management in the wetlands of the Kafue Flats. If all concerned parties come together to address this critical issue, sustainable and long-term water security can be achieved through collective efforts.

A five-step action plan created to spearhead this process includes:

- 1. Information collection, management and sharing**
- 2. Water allocation planning, implementation and enforcement**
- 3. Water use efficiency**
- 4. Sector water resources planning and management**
- 5. Institutional strengthening**



© SARAH BLACKWOLF

Fishermen, Kafue River, Southern Province, Zambia, Southern Africa.

1. INTRODUCTION

Zambia’s economy has grown rapidly over the past decade, and is projected to continue growing as the country develops. Its Sixth National Development Plan calls for: (i) the acceleration of infrastructure

development; (ii) economic diversification; and (iii) rural investments to stimulate economic growth and reduce rural poverty as Zambia moves toward its vision of becoming a middle income country by 2030. The plan also sets out key priority growth sectors that contribute toward the achievement of its sustained economic growth, poverty reduction and employment creation goals¹.

The nation’s gross domestic product (GDP) per capita rose by 80 per cent between 2000 and 2010. The copper sector played a key role in this growth, but all the other major sectors of the economy also expanded: manufacturing output grew by 50 per cent in the same period. GDP and employment contribution per sector is shown in figure 1. Agriculture contributes the smallest portion to the national GDP, yet provides the largest proportion of employment. The services sector however, contributes a large portion to the GDP but a comparatively smaller proportion to employment.

Trade out of Zambia forms an important source of foreign exchange for the country, while imports enable access to processed or manufactured goods such as machinery or transport not available within Zambia. The top six products (ranked according to proportion of export value) exported by Zambia are: refined copper (44 per cent), raw copper (29 per cent), sugar (6 per cent), corn (5.5 per cent), raw tobacco (4.9 per cent), and raw cotton (2.5 per cent)².

At a national level, water resources in Zambia are plentiful. The country receives an average of 1,020mm per year of annual precipitation. The total renewable water resources are 105.2km³ per year, with 25 km³ per year coming from external water resources. This equates to a 23 per cent dependency ratio for renewable water resources in Zambia. Water withdrawals in the country (per sector) are shown in figure 2. The total dam capacity of the country is 101km³.

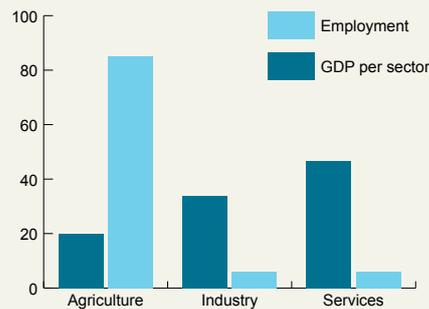


Figure 1: GDP contribution and employment per sector in Zambia (2013)

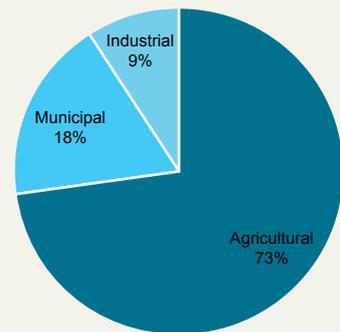


Figure 2: Zambia annual water withdrawals by sector

1 http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Zambia_-_Strengthening_Climate_Resilience_in_the_Kafue_Sub-Marin_-_Appraisal_Report.pdf
 2 <http://maxwellsci.com/print/ajias/v6-6-15.pdf>

1.1. THE KAFUE RIVER BASIN

The Kafue River traverses the Copperbelt, Central, Southern and Lusaka provinces. The basin represents approximately 20 per cent of Zambia’s total land area, and is the only one that falls solely within Zambia. The Kafue River is the largest tributary to the Zambezi River, contributing 9 per cent of its flow³.

The Kafue River basin is split into northern, central and southern regions. They were selected according to the major economy or form of water use within each sub-region of the river (see map below). Home to the Kafue Flats, the southern region is of particular interest in this study.



Figure 3: Left: River Basins of Zambia Right: Regions of particular interest

The Kafue River rises in the northwestern part of Zambia on the border to the Democratic Republic of Congo. In the northern region of the basin, mining in the Copperbelt is the most notable economic activity.

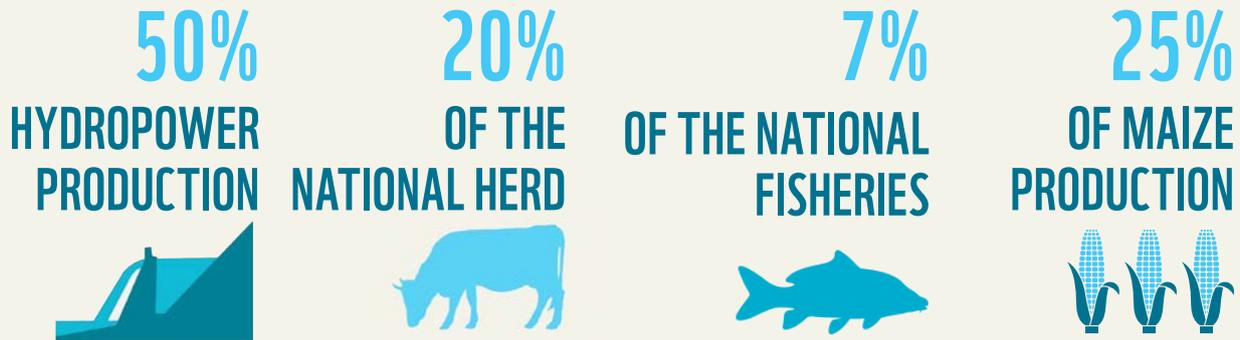
Following the upper reaches within the Copperbelt, the river flows in a southerly direction through the extensive Kafue National Park before passing through the Itezhi-Tezhi Dam. This is the central section of the Kafue River basin.

The southern portion of the Kafue basin is distinguished at the start by the Itezhi-Tezhi Dam in the west. The river proceeds through a network of marshes and wetlands until it reaches the Kafue Gorge and the Kafue Gorge Dam. Thereafter, it approaches its confluence with the Zambezi River, where the annual mean flow is 316m³ per second.

The Kafue Flats are of major ecological, industrial and socio-economic significance for Zambia. The basin is home to 52 per cent of the Zambian population, of which 65 per cent live in urban regions such as Lusaka or the Copperbelt, and 35 per cent live in rural areas. It is also a source of potable water for approximately 40 per cent of the Zambian population, and half of Zambia’s national hydroelectricity supply.

The region is home to the highest concentration of cattle in the country, with an estimated 20 per cent of the national herd (290,000 cattle) grazing on the flats in the dry season. An extensive sugar irrigation sector, supplying both domestic and export markets, also exists. The fisheries of the Kafue Flats are one of Zambia’s most productive wild fisheries, supplying both urban and rural markets. In all, the Kafue Flats wetland is estimated to support the livelihoods of more than 900,000 people.

³ http://siteresources.worldbank.org/INTAFRICA/Resources/Zambezi_MSIOA_-_Vol_3_-_State_of_the_Basin.pdf



In addition to the social and economic provisions gained from the river, it also supports and sustains vital ecological systems like wetlands, game reserves and bird sanctuaries. There are two national parks (Blue Lagoon and Lochinvar) within the area, both of which are Ramsar sites, in addition to the Kafue Flats Game Management Area.

Increasing water demands and variability resulting from climate change will heighten resource allocation stress. Economic production depending on the rich water resources within the Kafue River basin will face greater risk, negatively impacting the trade and economic development of the region. In anticipation of these risks, improved management of water resources is crucial.

The current water users in the Kafue Flats are reaching the limit of what can be provided for within the existing storage capacity. In dry years, unless further storage capacity is developed, these users will experience economic losses. In recognition of the existing water demands on the Kafue River catchment, there is currently a moratorium on permitting additional water rights until the completion of a full water balance study.

However, there are also alternative means of managing water use and efficiency within the basin. Through an improved understanding of the role of water throughout the value chain, the private sector can adopt progressive basin-wide strategies to manage the catchment sustainably. The private sector can and should mobilize to support laws, regulations and policies in order to develop and implement a basin management strategy.



Figure 4: Specific zones of interest in the Kafue Flats

1.2. PURPOSE OF THIS REPORT

The main objective of this report is to highlight a selection of pertinent risks and opportunities within the Kafue Flats, including considerations around water use and abstraction allocations, water quality and the impacts of climate change.

The purpose of the narratives is not only to understand how water resources are shared, but also to interrogate the implications of water resources used for production and trade. Understanding how water resources impact different sectors of the economy helps to identify core levers and change agents in the sector. However, there are likely to be numerous risks that fall outside the four core risk narratives and outside the scope of this report.

Our aim is to explain the role of water to individuals who are not water experts, but who make decisions within their sectors that dramatically influence water resources. By examining the realities of the different sectors located within the catchment, and the respective risks and opportunities that they face, potential solutions for managing the risks or leveraging the opportunities will be explored.

This report is targeted toward all stakeholders within the Kafue Flats who have an interest in its optimal functioning. This includes government ministries such as agriculture, energy and environment, as well as private sector companies that have their operations or supply chains in the catchment. Civil society organizations in the region may also find the report useful in understanding the interconnectedness of all the users within the Kafue Flats when it comes to maintaining a functioning ecosystem.

1.3. METHOD OF FRAMING THE RISK NARRATIVES

The concept of risk is often related to the likelihood and impact of an event. In these narratives, a qualitative approach has been adopted to allow the assessment of risk related to different aspects of the Kafue Flats.

This is particularly pertinent to resources that are not able to be quantified relative to each other in monetary terms.

Additionally, an in-depth literature review and a selection of interviews and meetings were carried out with selected stakeholders in an effort to identify major concerns within the catchment.

There are three basic ways to frame and categorize risks.

1. Categories

These range from water risks, ecological risks, social risks and economic risks. The risks themselves all interact across a number of sites within the Kafue Flats, resulting in challenges in water supply, quality and timing for some users or sectors.

Hydrological risks include factors such as the physical water flow and water quality along river stretches of particular importance. These risks are linked with the activities taking place along the river. Water quality and quantity impact the nature of activities that are able to take place, while the activities taking place along the river in turn impact water availability and quality.

Biological aspects of the catchment include the ecological function of the wetland system, including both fauna and flora. Biological risks are most directly associated with the functioning Ramsar sites such as the Blue Lagoon and Lochinvar National

Parks. The biological functioning of the river may also impact the ability of particular sectors to use the resources productively.

Social aspects of water-related risks are of particular importance for populations depending on the river system for their livelihoods. This includes the fisheries and livestock grazing that takes place to support communities living alongside the Kafue Flats. However, the livelihoods supported through the Kafue Flats are difficult to quantify exactly.

Economic linkages to the catchment are centred on the production deriving from water resources used within the Kafue.

These include power generation, agricultural production, industrial production and domestic water use. Without adequate hydrological resources or biological health within the system, economic production is not sustainable.

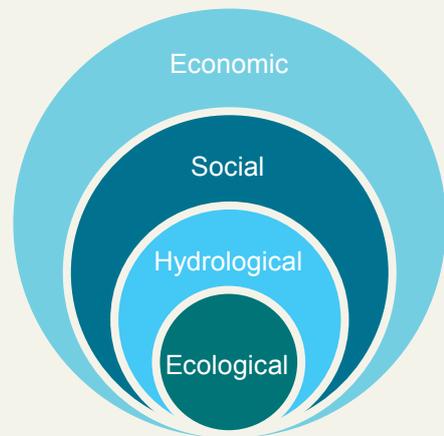


Figure 5: Scale risk lenses of the Kafue Flats

2. Sectors

These include the agriculture, hydropower, livelihoods, industry and the urban sector.

3. Geography

Risks may be conceptualized geographically, according to where they manifest within the Kafue basin. Risks associated with water quality are of great importance in the upper catchment within the Copperbelt and in the lower parts of the Kafue Flats, downstream of the Kafue industrial area and sugar growing area.

In order to create the risk narratives, the impacts on nature, people and business need to be linked with the hydrological and ecological functioning of the Kafue River system. These are not effectively communicated through a single framework, and therefore a variety of risk frameworks are used. The dependency of nature, people and business on water needs to be compared with the likelihood and impact of changes in the river system.

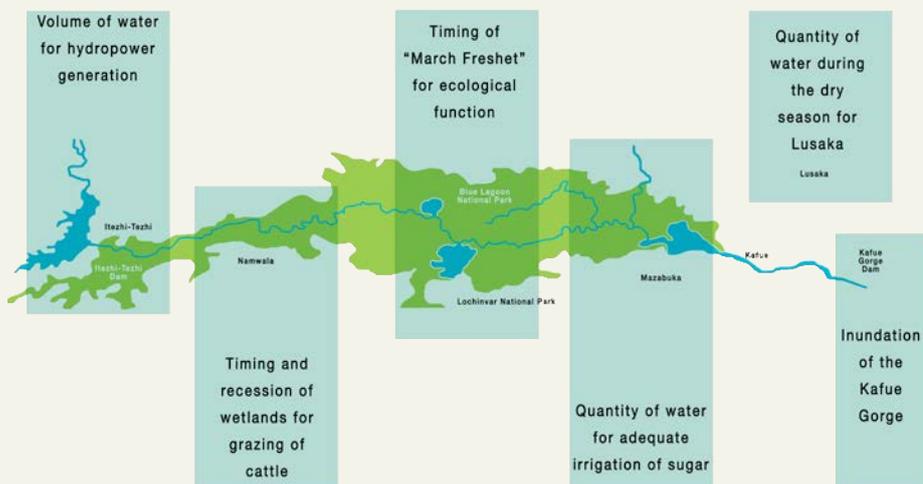


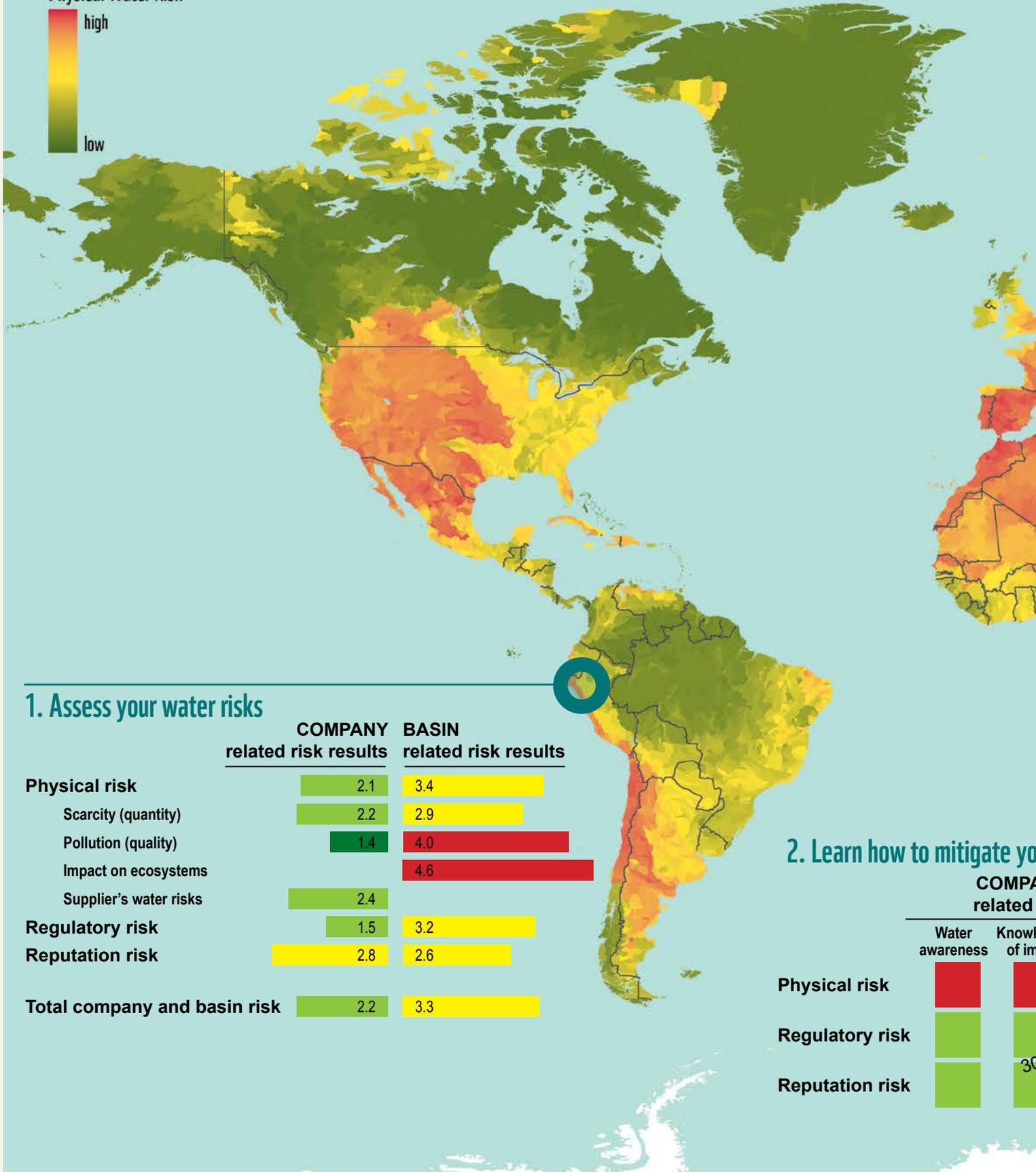
Figure 6: Geographic risk lenses of the Kafue Flats



THE WATER RISK FILTER

www.waterriskfilter.panda.org

Physical Water Risk



1. Assess your water risks

	<u>COMPANY</u> related risk results	<u>BASIN</u> related risk results
Physical risk	2.1	3.4
Scarcity (quantity)	2.2	2.9
Pollution (quality)	1.4	4.0
Impact on ecosystems		4.6
Supplier's water risks	2.4	
Regulatory risk	1.5	3.2
Reputation risk	2.8	2.6
Total company and basin risk	2.2	3.3

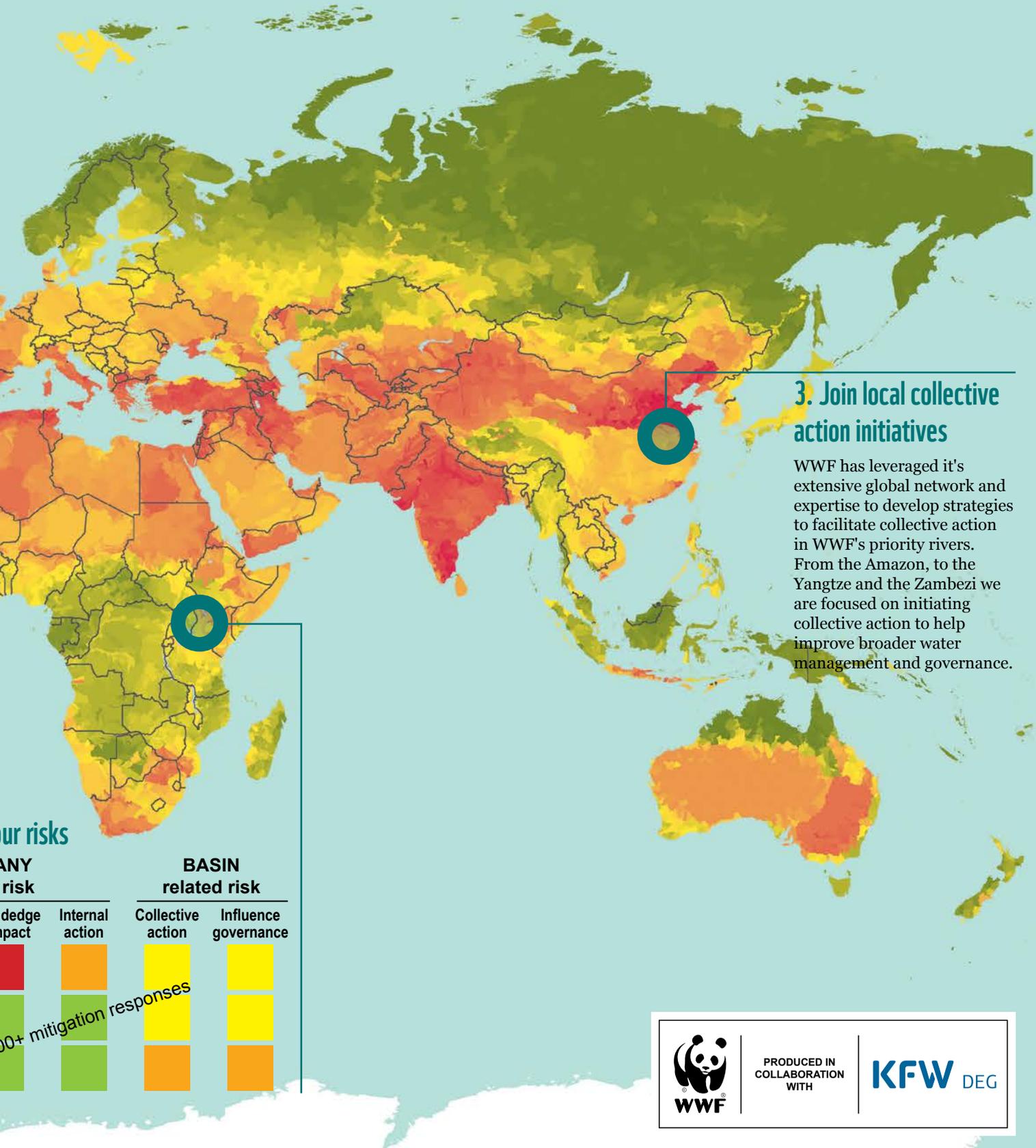
2. Learn how to mitigate your water risks

	<u>COMPANY</u> related risk results
	Water awareness
Physical risk	3.4
Regulatory risk	3.2
Reputation risk	3.0

WWF's Water Risk Filter is a free online tool to help companies and investors ask the right questions about water in order to better understand their water related risks. It helps understand exposure to risks at a site level and offers guidance on what to do in response.

The Water Risk Filter helps users progress along the five steps of water stewardship, starting with step 2: knowledge of impact. It also inspires companies to take internal action (step 3) and join collective action initiatives (step 4) by providing concrete risk mitigation responses.

- 1 Water awareness
- 2 Knowledge of impact
- 3 Internal action
- 4 Collective action
- 5 Influence governance



3. Join local collective action initiatives

WWF has leveraged its extensive global network and expertise to develop strategies to facilitate collective action in WWF's priority rivers. From the Amazon, to the Yangtze and the Zambezi we are focused on initiating collective action to help improve broader water management and governance.

Water risks

ANY risk		BASIN related risk	
Knowledge of impact	Internal action	Collective action	Influence governance
Red	Orange	Yellow	Yellow
Green	Light Green	Yellow	Yellow
Green	Light Green	Orange	Orange

100+ mitigation responses



2. LIVELIHOODS AND TOURISM DEPEND ON A HEALTHY ECOLOGICAL SYSTEM

According to 2013 estimates by the Zambian Central Statistics Office, the entire Kafue Flats is home to approximately 1.2 million people (representing 9 per cent of the total Zambian population, see Figure 7) and are estimated to support more than 900,000 people directly through livelihoods that are dependent on the flats themselves.

73 per cent of the total Kafue Flats population is rural, while 27 per cent is urban.

Social zones along the Kafue basin are distinct. From the Itzhi-Tezhi Dam, along the Kafue Flats to the west of Mazabuka, the area supports people with traditional lifestyles dependent on grazing cattle and fishing. The region around Namwala, a district within the Kafue Flats, is mostly rural, with a high level of dependence on agriculture. This area is home to the people most vulnerable to floods and changes to the ecosystem in the basin, as their livelihoods are dependent on subsistence farming, fishing and selling various articles such as reed mats and baskets⁴.

The Kafue Flats are also home to an estimated 20 per cent of the national herd (290,000 cattle) grazing on the flats in the dry season. Fishing is a major source of protein for the inhabitants, while the cattle are viewed as capital rather than for consumption. The fisheries of the Kafue Flats are also one of Zambia's most productive wild fisheries, supplying both urban and rural markets.

Without the adequate management of water resources in the region, in particular the adequate management of the operating rules of the dams, this region faces significant risks due to the wide range of inter-related stakeholders dependent on the resource.

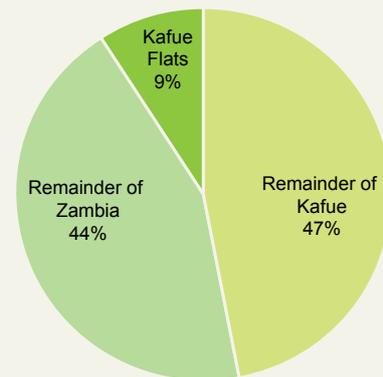


Figure 7: Population of Zambia, Kafue River Basin and Kafue Flats

“Wetlands play a vital role in contributing to food security.”

Kakuru et al, (2013)

2.1. LIVELIHOODS

Livelihoods in the Kafue Flats depend on tangible and non-tangible benefits from the Kafue Flats.

Wetlands provide an important natural resource upon which the local economy depends. They provide benefits not only to the local society, but also to people living further afield. The Kafue Flats are recognized globally for their vital role in sustaining a wide array of biodiversity, and for providing goods and services.

The wetlands provide both tangible and non-tangible benefits to various communities. Tangible benefits include water for domestic use and for watering livestock. Support to dry season agriculture; the provision of materials to create handicrafts, building materials, medicines; and food resources such as fish are additional tangible benefits. Non-tangible benefits of the Kafue Flats include flood

⁴ Strategy for Flood Management of the Kafue River Basin, 2007. Associated Programme Flood Management. http://www.preventionweb.net/files/2733_StrategyZambiaEn.pdf

control, water purification, water table maintenance, microclimate moderation and storm protection. Wetlands are also important fauna and flora habitats with aesthetic and heritage values. All of these benefits influence the food security and resilience of the livelihoods that depend on the region.

Both the tangible and non-tangible benefits are dependent on a functioning wetland ecosystem. In particular, hydrological processes such as annual flooding are critical in regenerating fish populations, while the receding flood line is an important source of grazing for cattle.

2.2. FISHERIES

Fisheries are critical for protein sustenance and livelihoods in the Kafue Flats.

In Zambia, fisheries contribute 1 per cent to the average national GDP⁵. Fish represents between 20 per cent⁶ and 40 per cent⁷ of the national protein intake, with areas alongside major fishing sites even more dependent on fish protein. In the Kafue Flats, 50-60 per cent of all protein consumed by the rural population (900,000 people) is attributed to fisheries⁸. Natural fisheries represent 90 per cent of fish production in Zambia, with fish farming contributing 10 per cent. Fisheries within the Kafue Flats represent approximately 7 per cent of the total fisheries industry in Zambia.

Across Zambia, it is estimated that approximately 300,000⁹ people earn part of their income directly as fishers and fish farmers or indirectly as traders, processors and other service providers (boat building and repair, net manufacturing, fuel wood supply, power supply, transportation etc.). The Kafue Flats and Itezhi-Tezhi represent two of the nine major fisheries, which include the Kariba, Tanganyika, Bangweulu, Mweru, Luapula and Mweru lakes, the Zambezi River and the Lukanga Swamps¹⁰.

Fishing in the Kafue Flats has been an important occupation and is a major element of the local economy alongside cattle rearing and crop farming. It is estimated that half of the households within the Kafue Flats are dependent on fisheries for their total household income¹¹. However, it has been observed that fishery, as a source of livelihood, is being threatened by over-fishing and bad fishing practices.

In the Kafue Flats, there has been a significant increase in the number of fishermen over the years, who are mainly new settlers from other regions of the country. Due to its proximity to urban centres, the Kafue floodplain is exposed to intensive fishing pressure. In the 1970's, the Kafue fisheries supported yields in excess of 11,000 tonnes. However, in recent years this figure has almost halved, with the fishery producing an annual catch of over 6,000 tonnes¹². Due to over-exploitation, a change in the flooding regime, and invasive plant and fish species, there has been a decrease in the size of species being caught, with species such as *Brycinus lateralis* (known as stripped robber) and juvenile breams more common today¹³.

“Fishing in the Kafue Flats has been an important occupation and is a major element of the local economy.”

5 http://www.worldfishcenter.org/resource_centre/WF_2449.pdf

6 Ibid.

7 http://fsg.afre.msu.edu/zambia/status_of_fish_population_in_Zambia_water_bodies

8 http://uctscholar.uct.ac.za/PDF/76552_Ngoma_P.pdf

9 http://www.worldfishcenter.org/resource_centre/WF_2449.pdf

10 Ibid.

11 http://uctscholar.uct.ac.za/PDF/76552_Ngoma_P.pdf

12 http://acpfish2-eu.org/uploads/projects/id10/FTR_21_June_2011.pdf

13 Chimba N. and Musuka, C. Impact of closed fishing season on the livelihood of fishers: A case of Stratum I of Kafue Fishery. 2014. 2 (1): 49 – 62, International Journal of Life Sciences Research



THE FISHERIES OF THE KAFUE FLATS ARE ONE OF ZAMBIA'S MOST PRODUCTIVE WILD FISHERIES AND REPRESENT APPROXIMATELY 7% OF THE TOTAL FISHERIES INDUSTRY IN THE COUNTRY.

Since the 1990s, the Kafue Flats have experienced a large influx of people from the Western province into the area. As a result, fishing in the Kafue Flats is mostly carried out by immigrants to the area representing an array of tribes, including Lozi and Bemba fishermen, while livestock farming is carried out by pastoralists local to the area. “Fishing effectively performs a safety net function in the Kafue floodplain for disenfranchised households that have immigrated into the area due to its open access and weaker management regime.¹⁴” In the Kafue floodplain, “fishing communities are further trapped in other dimensions of poverty including poor education, health and sanitation facilities; marginalization and poor road infrastructure¹⁵.”

2.3. SMALLHOLDER AGRICULTURE

Smallholder agricultural production is dominated by maize, which is vulnerable to climate change.

Maize is Zambia’s staple crop and is grown in almost all parts of the country with approximately 80 per cent grown by small-scale farmers¹⁶. Commercial farmers, who unlike small-scale farmers often use irrigation, only account for about 20 per cent of the country’s total annual maize production¹⁷. Among the nine Zambian provinces, Eastern province is the largest maize producer, followed by Southern and Central provinces. Luapula, North-Western and Western provinces only register a small amount of production (the Kafue Flats are located in Southern Central and Lusaka provinces and only cover part of each province).

The following chart (figure 8) indicates the importance and scale of maize cultivation in Southern province relative to the remainder of the provinces of the entire Kafue River basin.

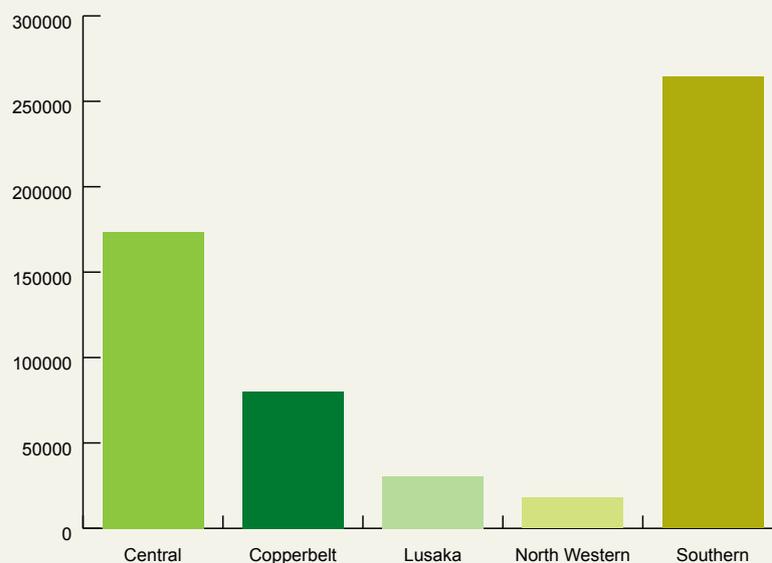


Figure 8: Maize planted in the Kafue River Basin

14 Chimba N. and Musuka, C. Impact of closed fishing season on the livelihood of fishers: A case of Stratum I of Kafue Fishery. 2014. 2 (1): 49 – 62, International Journal of Life Sciences Research

15 *ibid.*

16 <http://www.zda.org.zm/sites/default/files/Sector%20Profile%20-%20Agriculture.pdf>

17 *ibid.*

The projected annual national demand for maize is about 1,600,000 tonnes, categorized as indicated in the figure 9.¹⁸ Home consumption is the largest demand for maize in Zambia, while Food Reserve Agency (FRA) stockpiling and animal feed are also important. Thirty-three per cent of rural households are buyers of maize only, while 21 per cent of rural homes are net sellers. Note however, that there is a highly concentrated pattern of surplus generation, where 2 per cent of households account for 50 per cent of marketed maize surplus.

In the Southern province portion of the Kafue Flats, maize is the most cultivated crop by smallholder farmers. Maize is grown both as a food source to support food security, as well as to sell as a cash crop when there are surplus yields.

As it is grown by smallholders, maize is not irrigated in the Kafue basin. A lack of irrigation in addition to limited fertilizer use and other inputs results in reduced maize yields, with the Southern province reportedly having the lowest yields in the entire Kafue River basin¹⁹.

Climate change projections may further exacerbate the vulnerability of small-scale, rain-fed maize farmers in the Kafue basin.

In terms of hydrology, direct precipitation contributes substantially to water inputs to the Kafue Flats. The runoff from

the upstream catchment accounts for 45 per cent of water inputs to the area, while the remaining 55 per cent comes from direct precipitation to the Kafue Flats from its sub-catchment. In terms of outflows from the Kafue Flats, evapotranspiration is especially important, accounting for 49 per cent of total hydrologic outputs in some sub-catchments. Therefore, as temperatures are projected to increase in the Kafue catchment, there is likely to be increased evapo-transpiration from the Kafue Flats, further reducing the availability of water to the system.

Hence, rain-fed agriculture in the Kafue Flats will be under significant pressure should rainfall projections decrease. Given that climate science indicates that extreme events will increase in intensity and frequency, communities in this area will continue to come under additional strain due to their geographic location.

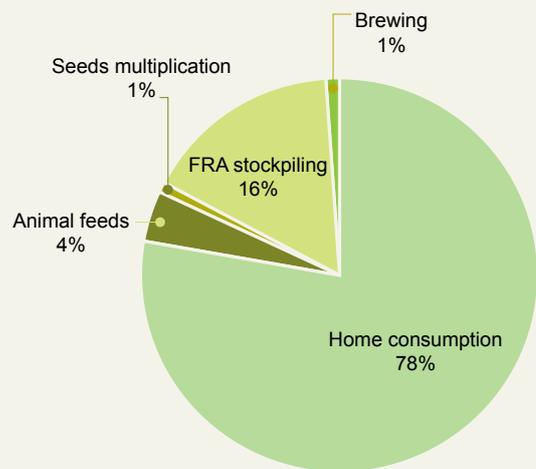


Figure 9: National demand for maize

¹⁸ Ibid.

¹⁹ Zambian 2010-2011 Crop Forecast Survey

2.4. LIVESTOCK

Livestock play a fundamental role in supporting livelihoods through draught power, milk and meat production.

Across Zambia, livestock plays an important role, especially in poorer communities, in the provision of daily nutrition in the form of meat, milk and eggs, the provision of power for land cultivation, and the maintenance of soil fertility. Livestock may also be used as a ready source of cash and for social and traditional occasions and ceremonies. Cattle are especially important in the Southern province.

Livestock production in the Kafue Flats is practised alongside crop production, as the area has the highest concentration of cattle in the country. Namwala, Itezhi-Tezhi and Mumbwa, all located within the Kafue Flats area, are the main livestock rearing districts.

In Zambia, about 23 per cent of the per capita supply of protein comes from animal products. However, with regard to meat consumption, beef is the most preferred, followed by pork, chicken, rabbit, mutton/lamb and goat meat. Cattle contribute at least 61 per cent of the meat and milk consumed in the country. In view of the above, the livestock sector has tremendous potential and capacity to contribute to poverty alleviation, to increase the socio-economic status of most of the population and, consequently, to contribute significantly to the economic growth of the country.

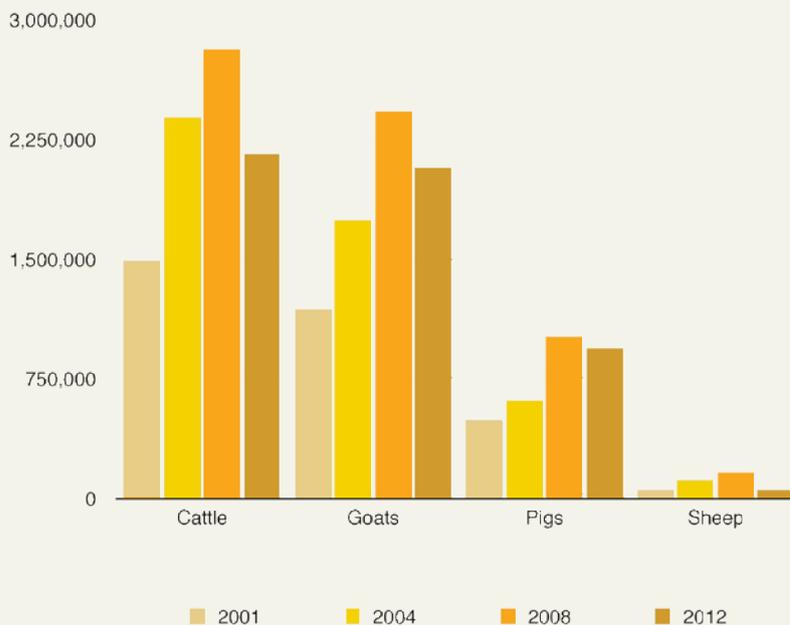


Figure 10: Livestock in Zambia (2001-2012)

According to the Central Statistics Office, the livestock sector contributes 35 per cent to the Zambian Agricultural GDP and approximately 3 per cent to the national GDP. Both the traditional and commercial sectors contribute to the production of livestock products in Zambia. The traditional sector, representing 83 per cent of the total cattle population, has the larger number of animals when compared to the commercial sector.

THE KAFUE FLATS ARE ESTIMATED
TO SUPPORT 20% OF THE NATIONAL
LIVESTOCK HERD.



The Kafue Flats are home to approximately 290,000 head of cattle, an estimated 20 per cent of the national herd. The majority of livestock breeds used in the area fall under traditional, indigenous breeds. While productivity levels may be low, these breeds are more adapted to local conditions and are less demanding on management. Improving the management of these breeds (using low external-input, sustainable technologies) could, nevertheless, significantly raise the productivity of these animals.

The average stocking rate of cattle is normally 5 per hectare in average conditions. However, due to the fertility of grazing in the Kafue wetlands, the carrying capacity is sometimes stretched to 15 cattle per hectare²⁰. This is not sustainable however, as evidence shows the decrease in quality grass cover as a result of over-grazing.

Like rain-fed maize, traditional livestock production in the Kafue Flats is vulnerable to changes in the ecological functioning of the area, in addition to climate change. Without the receding annual February-March flood, new grazing along the Kafue Flats is not available. Furthermore, the amount of grazing outside the banks of the Kafue River is particularly vulnerable to climate change. Without the flooding regime of the Kafue Flats or adequate rainfall to rejuvenate the already stressed grazing areas, there are likely to be negative effects on the production of livestock in the region, should the natural grazing resource fail.

2.5. TOURISM

The tourism sector depends on the functioning ecology of the Kafue Flats.

According to the Zambia Wildlife Authority, “Zambia’s tourism is nature based and the majority of Zambia’s biodiversity is contained within this extensive wildlife estate, which accounts for about 80 per cent of Zambia’s tourism activities. In 2013, the direct contribution of tourism amounted to 2.3 per cent of total GDP, while the total contribution amounted to 5.2 per cent. This is projected to grow approximately 8 per cent per annum from 2014 to 2024²¹. The direct contribution of employment amounts to 1.3 per cent, while the total contribution is 3.6 per cent. The wildlife estate, comprising 20 National Parks, 36 Game Management Areas and one bird sanctuary, is the main tourism product after the mighty Mosi-oa-Tunya (Victoria Falls).”²²

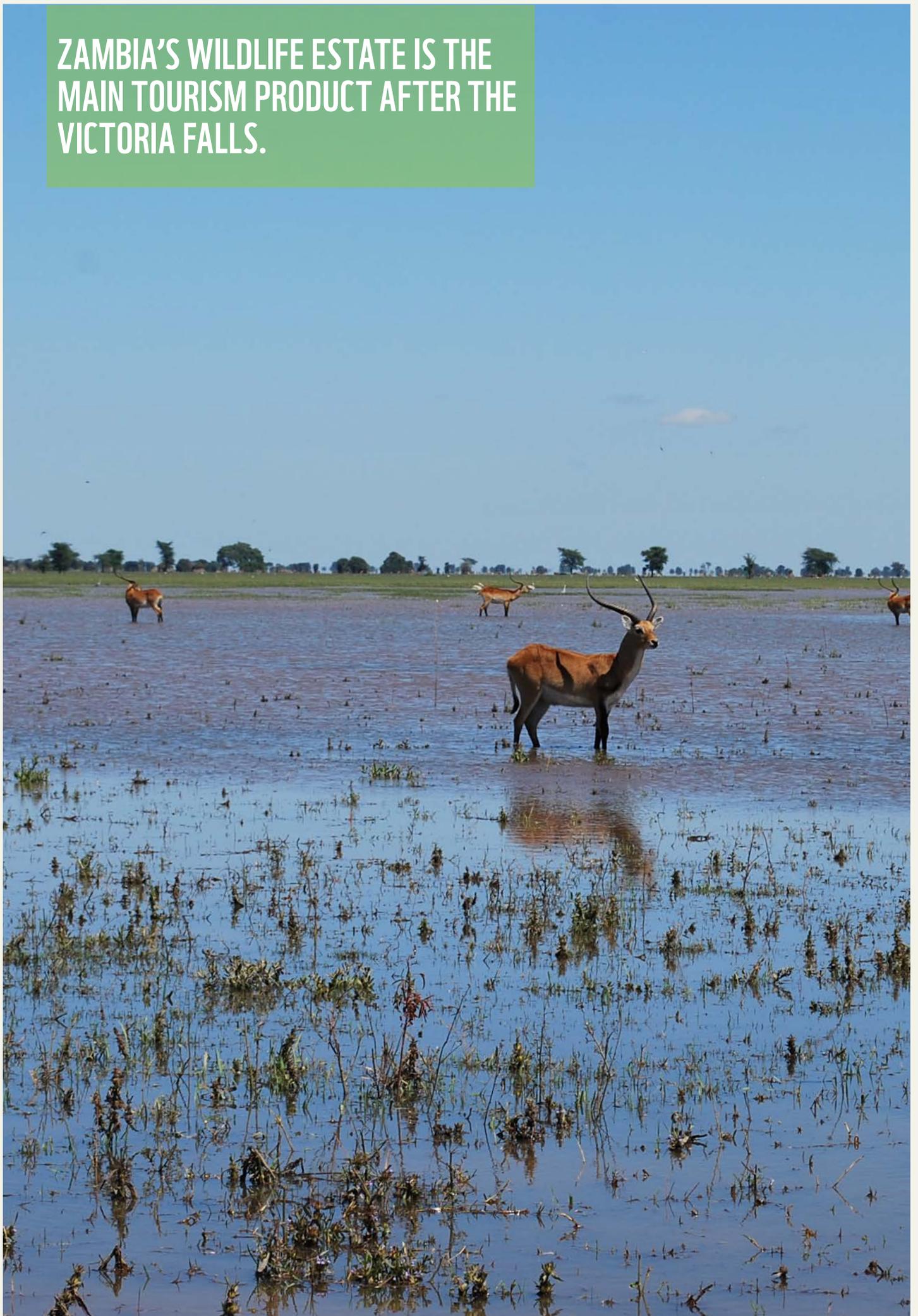
Within the Kafue River basin, water consumption by the tourism sector has been estimated as 85 MCM per year. The Kafue Flats are likely to represent approximately 30 per cent of this. The Zambian national tourism sector water needs are calculated at 250L per bed per day in lodges across Zambia, with approximately 5,000 beds at a daily occupancy rate of 68 per cent. Therefore, although the water requirements of the tourism sector in the area are not significant on their own, its dependence on a functioning ecosystem represents embedded water needed to ensure that the Kafue Flats are maintained hydrologically.

20 <http://www.fao.org/ag/AGP/AGPC/doc/counprof/zambia/zambia2.htm>

21 http://www.wttc.org/-/media/files/reports/economic_impact_research/country

22 <http://www.zambiatourism.com/about-zambia/conservation/zambia-wildlife-authority>

ZAMBIA'S WILDLIFE ESTATE IS THE
MAIN TOURISM PRODUCT AFTER THE
VICTORIA FALLS.



2.6. THE POTENTIAL IMPACT OF CLIMATE CHANGE

Rural livelihoods and smallholder agriculture in the Lower Kafue rely on seasonal rainfall and flooding patterns.

Ecosystem health is linked to flooding and rainfall patterns. Climate change has the potential to impact the health of ecosystems and the use of natural resources. Changes in flooding patterns from the Itezhi-Tezhi Dam already disrupt proper ecosystem functioning, which may be further disrupted by climate change. An increase in temperature may also cause an increase in evapotranspiration. Currently, approximately 49 per cent of the outputs from the Kafue Flats are attributed to evapotranspiration.

Changes in temperature and rainfall may directly impact biodiversity and natural resources by creating circumstances more conducive to alien species growth and less conducive to native species growth. For example, the water hyacinth has plagued the Kafue, and now extracts significant volumes of water, clogs dam operations, and disrupts normal ecosystem functioning, which will also have an impact on fish populations.

Over-extraction of natural resources may also be exacerbated by climate change. Deforestation and the extraction of plant resources for use in charcoal production and as biofuel is a significant concern in the Lower Kafue River area, as a result of development, with these sources accounting for 75 per cent of all energy used in Zambia (NCCRS 2010).

Rural livelihoods within the Kafue Flats are especially vulnerable to changes in seasonal rainfall and flooding. Maize, soya, cotton and sorghum are cultivated during the wet season from November to March, while some crops are also grown after the recession of the flood in June-July. The timing of flooding is now controlled by the Itezhi-Tezhi Dam, which regulates water flow for the Kafue Gorge Power Station. However, climate change may cause disruptions in the operation of the dam. Fishing and cattle grazing depend on the arrival and subsequent recession of the flood waters, noting however that extreme flooding will cause significant damage to homesteads in the catchment.

Fisheries depend on the flooding to stimulate breeding and migratory patterns. Delayed or lower flooding will impact fish populations. Cattle-rearing depends on grazing the flood plains after the floods have receded. Lower flooding due to the dam controls will reduce the amount of grazing available.

On the opposite spectrum, extreme flooding may lead to infrastructure damage and health concerns for livestock due to the pooling of water. Rural livelihoods directly downstream of Itezhi-Tezhi are especially at risk from flooding. For instance, heavy rains in 2006 forced ZESCO to start releasing excess water from the dams, causing flooding downstream. Depending on the timing of the flooding, some crops may be destroyed before reaching maturity. Alternatively, some flooding events may take place when crops are more mature, thereby having less of an impact (Zambia Flood Strategy).

Therefore, livelihoods along the Kafue Flats are particularly at risk of a deteriorating ecological functioning of the area. The preservation of environmental flows and conservation strategies to ensure ecological functioning is of paramount importance. However, while the deterioration of the Kafue Flats may be compounded by climate change, it is ultimately caused by pressures from competing water users, as well as population pressure. Hence, the failure of the ecosystem function in the Kafue Flats is likely to result in depopulation to Lusaka or the mining regions.

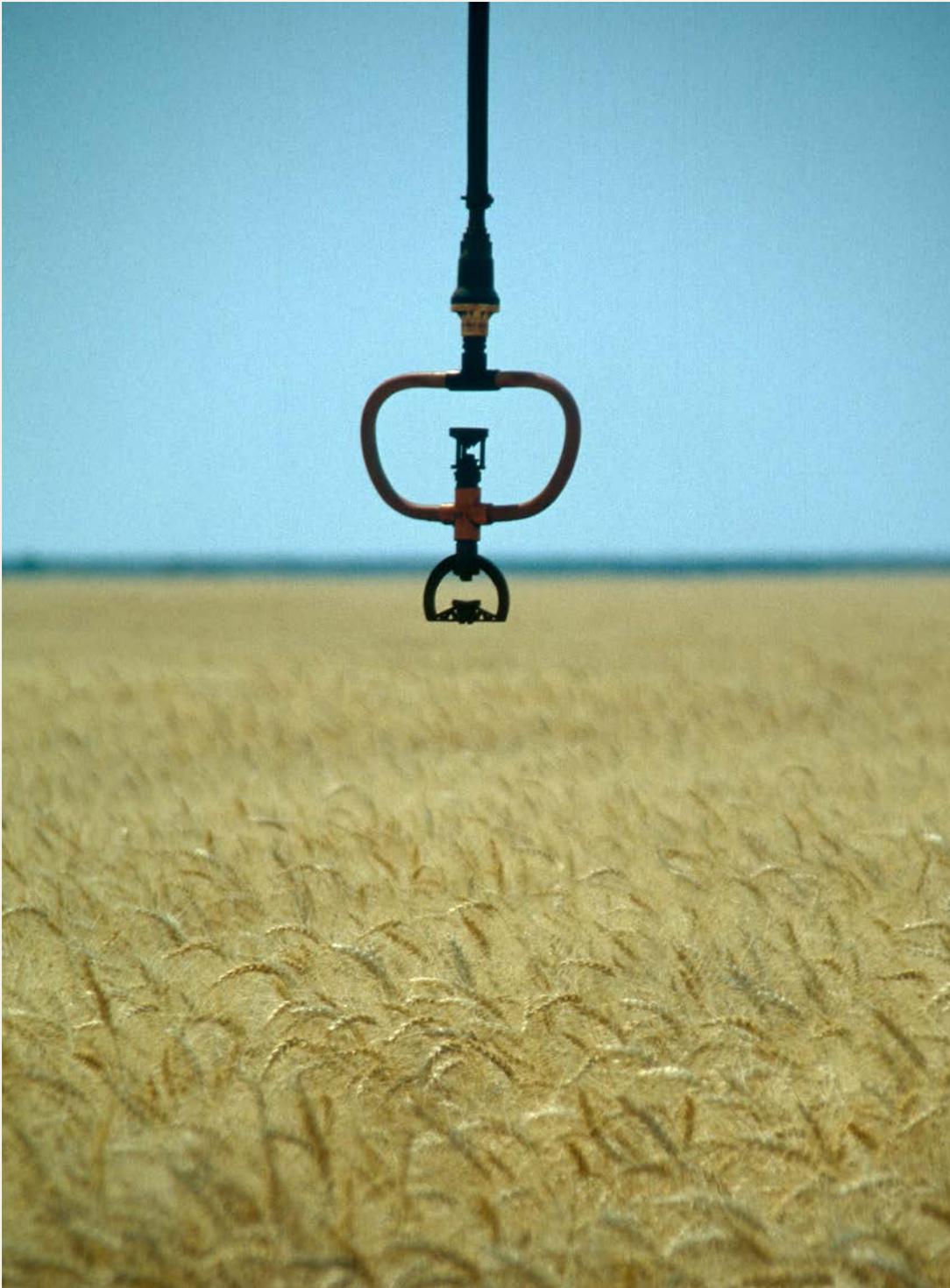
“Livelihoods along the Kafue Flats are particularly at risk of a deteriorating ecological functioning of the area.”

2.7. SUMMARY OF UNDERLYING RISK DRIVERS TO LIVELIHOODS IN THE KAFUE FLATS

The major pressures affecting livelihoods in the Kafue Flats include a deteriorating ecosystem. This includes negative impacts on the ecosystem goods collected from the area, such as thatching for grass or reeds for the construction of fishing traps. Reduced agricultural production also places pressure on the vulnerability of people's livelihoods through negatively impacted maize yields. Reduced grazing may also result from a decrease in the rainfall or the flood edge of the Kafue Flats, thereby negatively impacting livestock production. As already indicated, these pressures are a result of population migration from other areas in Zambia to the Kafue Flats, water use stress from competing users, and climate change.

The institutions relevant to addressing these risks include the Water Resources Management Agency (WARMA); the Ministry of Energy and Water Development (MEWD); the Ministry of Agriculture and Livestock (MAL) that plays an important role in understanding the nature of agriculture in the Kafue Flats; and the Ministry of Finance and National Planning (MFNP), a critical player in supporting the reduction of poverty as a result of loss of livelihoods.

In terms of consequences, Lusaka is impacted through the migration of destitute people from the Kafue Flats in search of economic opportunity. The food and beverage industry is also impacted, as they are dependent on inputs from the Kafue Flats including maize, milk and beef from smallholder traditional farmers, in addition to the commercial farmers in the region.



©SARAH BLACKWOLF

Centre pivot irrigation of wheat crop, Mazabuka, Zambia.

3. THE FOOD AND BEVERAGE INDUSTRY DEPENDS ON THE KAFUE FLATS

Agriculture is a major employer in Zambia, contributing 20 per cent to the country’s GDP²³, while agro-processing and manufacturing currently contribute 11 per cent. Despite being a major employer the agriculture sector alone is not able to bring about meaningful development in the country²⁴. Livelihoods stemming from the land need to be supported through alternative or additional income such as agro-processing²⁵. With an increase in investment, “it is hoped that the sector can contribute more to Zambia’s economic well-being and bring about tangible benefits to the Zambian people such as employment creation and poverty alleviation²⁶.” Within the agro-processing industry, the food and beverage sector contributes a major proportion of economic input.

3.1. IRRIGATION IN ZAMBIA

The Kafue Flats supports the majority of irrigation in Zambia.

The agricultural water demand for irrigation, livestock and fish ponds is estimated to be 2,333 MCM per year in Zambia (2015), covering an irrigated area of 114,000 hectares. The total agricultural water demand for the Kafue River catchment is 1,000 MCM per year.

In 2008, the World Bank conducted a study to estimate the extent of irrigated agriculture in the Kafue River catchment. They found that the estimated total irrigated area in the Kafue constituted 81 per cent of the formal national irrigated area, while the Kafue Flats alone accounted for 64 per cent of the total national irrigated area, with the majority attributed to sugar cane growing.

An increase in the area planted with sugar cane has resulted in 867 MCM per year of irrigation water abstracted, which is attributed to the Kafue Flats. This is more than the total permits for agricultural water use in the catchment, indicating the possibility of unregistered water users abstracting water without a permit – an issue that should be of significant concern to all water users.

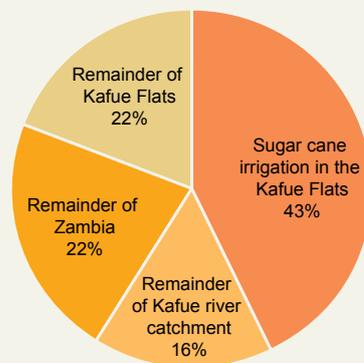


Figure 11: Irrigated area in Zambia

23 <http://www.gfmag.com/global-data/country-data/zambia-gdp-country-report>

24 <http://www.zda.org.zm/sites/default/files/Sector Profile - Agriculture.pdf>

25 <http://www.zda.org.zm/sites/default/files/Agro-processing 2014.pdf>

26 <http://www.zda.org.zm/content/agro-processing>

3.2. SUGAR

Sugar is a major commercial crop of the Kafue Flats.

Zambia is one of the world’s lowest-cost producers of sugar. However, production in Zambia represents only 1 per cent of the global production of sugar. In Zambia, the sugar sector is dominated by Zambia Sugar, followed by Kafue Sugar and Kalungwishi Estates.²⁷

The largest commercial sugar cane grower in Africa, Nakambala Sugar Estates, is owned by Zambia Sugar, which is in turn owned by Illovo, who are in turn owned by Associated British Foods. Illovo represents approximately 90 per cent of the total sugar production in Zambia, and the Mazabuka area is home to 89 per cent of the country’s total sugar production.

Sugar is an important agricultural export, and accounts for 3 to 4 per cent of GDP. The sugar industry provides 11,000 jobs across the country, while the sugar is produced for local use and for export, providing both food security and foreign exchange.

Sugar production has increased since privatization and extensive foreign direct investment into new technologies. Since 2000, there has been a surge in the expansion of smallholder out growers, in addition to Kafue Sugar and Zambia Sugar expanding their capacity. The sugar sector generates approximately US\$45 million in gross export revenue annually, which is double the amount it generated in the mid- 1990s.²⁸

Zambia Sugar is the largest irrigation scheme in Zambia, with an area of 14,500ha under sugar cane, and a further 5,000ha under out grower schemes. Nakambala Sugar Estates also depends on irrigation, pumping water from the Kafue River into night reservoirs. Every month, 16 MCM are drawn from the river, of which 12.3 MCM are used for irrigation (Mwanza, personal communication).

Zambia Sugar generates the majority of its own power through a 40MW bagasse-fired power plant, thereby reducing its dependence on hydropower generated through the Kafue Gorge. This has a significant impact on reducing their water footprint associated with hydropower dependence. They are however, heavily dependent on adequate water resource availability from the Kafue Flats. The Nakambala Sugar Estate, owned by Zambia Sugar, is the single largest irrigator withdrawing more than 720,000m³ per day to irrigate over 13,000ha²⁹.

Sugar is a major component of soft drinks. The carbonated soft drinks market in Zambia is dominated by Coca-Cola and PepsiCo. Other medium-sized soft drink companies, including Varun, a PepsiCo franchisee, and California Beverages have entered the market in recent years, eroding the dominance of Zambian Breweries and their Coca-Cola franchise.

All of these producers source their sugar from Zambia Sugar.

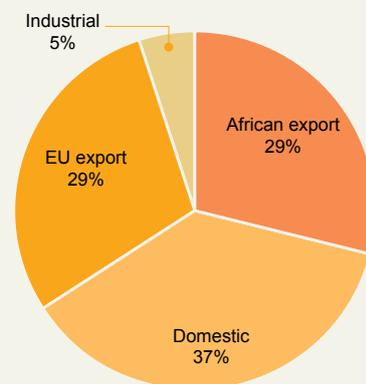


Figure 12: Zambia Sugar consumption and exports (2011)

27 http://personal.lse.ac.uk/sutton/sutton_zambia_press.pdf

28 <https://openknowledge.worldbank.org/bitstream/handle/10986/3075/487740ESW0P1021C0Disclosed071131091.pdf?sequence=1>

29 Zambia Sugar, 2010

Zambia Sugar (<http://www.illovosugar.co.za/About-us/Zambia>)

Zambia Sugar is headquartered Lusaka, with cane estates and a sugar processing mill in Mazabuka, located in the Kafue Flats. The company is responsible for approximately 90 per cent of national sugar production.

The company is now producing raw and refined sugars with an annual sugar production capacity from around 200,000 tonnes to 450,000 tonnes. The company has over 1800 permanent employees, whilst over 4,100 agricultural workers are employed during peak periods. The company also produces specialty sugars for export to the EU and syrup for local consumer markets.

In addition to the 17,000ha of its own land, Zambia Sugar works with 16 groups of small-scale farmers and commercial farmers that grow a further 10,000ha between them.

Once the cane is grown and collected, the Nakambala Sugar Mill crushes the sugar cane to extract raw sugar. Zambia Sugar has the capacity to produce 400,000mt of raw sugar per annum. A tenth of the sugar is then refined. Most of Zambia Sugar's refined sugar is sold in bulk to industrial users such as beverage manufacturers and manufacturers of biscuits and sweets.

In 2012, 150,000mt of raw sugar was sold domestically as household sugar and brown sugar, while 238,000mt was exported to Africa or the EU. Syrup, caster sugar and other specialty sugars are produced in smaller quantities, while molasses is sold as animal feed both to the local market and to South Africa.

In addition, some maize produced in Zambia goes into the production of beer. The Kafue River basin is the largest maize-producing catchment; newly established barley plantations are also found within the basin.

Lastly, most bottling or production facilities are based in Lusaka, representing a large proportion of water used in the city. Although the majority use groundwater as their primary water source, this abstraction does impact the amount of water required from the Kafue River.

The cultivation and processing of sugar produce environmental impacts through the loss of natural habitats, intensive use of water, heavy use of agro-chemicals, discharge and runoff of polluted effluent and air pollution. This leads to the degradation of wildlife, soil, air and water where sugar is produced and of downstream ecosystems.

BEVERAGE PRODUCTION IN ZAMBIA IS HIGHLY DEPENDENT ON THE PRODUCTION OF SUGAR IN THE KAFUE FLATS



©MARTIN HARVEY/WWF

Irrigating sugar cane fields. Local people have problems navigating the river and fish suffocate. Kafue Flats, Zambia.

3.3. BARLEY

Locally grown barley for the production of beer is mostly sourced from the Kafue River Basin.

Historically, Zambian Breweries imported the barley used for beer production from Zimbabwe. In 2009 however, this supply became unstable, necessitating the importation of barley from South Africa and Europe and resulting in the doubling of input costs³⁰. In response, Zambian Breweries, in partnership with local farmers, began a program of local cultivation, which became self-sufficient in 2011. The Zambian-grown barley was then exported to Zimbabwe for malting, and returned to Zambia. Zambian Breweries are currently constructing (since October 2014) their own (US\$32.6 million) malting facility in Zambia. With an initial production capacity of 18,000 tonnes per annum, the plant will meet local demand with an excess for export to regional markets. The construction of the malting facility will save Zambia US\$10 million in import costs per year³¹.

In 2012, the barley growers had sufficient surplus to export some barley. Hops and yeast for the beer production process are imported, while sugar and maize are bought locally.

The production of barley is carried out as a secondary revenue stream for the commercial wheat growers in Zambia. Warm, dry Zambian winters make the ideal growing conditions for the cultivation of irrigated barley, with farmers reaching globally competitive yields of approximately 6 tonnes per hectare.

Zambian Breweries

Zambian Breweries is the only Zambia-based manufacturer of lager beer, produced under its Mosi and Castle brands. It also produces Carling Black Label and Eagle beers under license. Zambian Breweries, together with National Breweries and Heinrich's Syndicate, are subsidiaries of SABMiller Plc. Zambian Breweries reported a turnover of US\$236 million for the year 2012, and employs 1,100 people, while National Breweries reported a US\$50 million turnover in the same year, employing 560 people. Heinrich's Syndicate employs 200 people.

Zambian Breweries has an annual production capacity of 750,000hL at the Lusaka plant and 300,000hL in Ndola. It produces Mosi, Mosi Gold, Castle Lager, Carling Black Label and Eagle beer, in addition to Coca-Cola. In 2011, the company produced 1,100,000hL of clear beer and 560,000hL of soft drinks. Beers, including Castle Lite, Miller, Peroni and Black Label are imported.

The water, maize and more recently the barley used for production, are sourced locally. Hops and specialist yeast is imported. Flavourings and concentrates for soft drinks are also imported, along with the glass bottles. The development of a local market for barley is still nascent, with 2012 being the first year sufficient barley was produced within Zambia to meet the needs of the market.

In South Africa, SABMiller carried out a water footprint analysis to determine where the majority of the embedded water for the production of beer lay, see Figure 13. They found that 84 per cent of the embedded water in beer was through locally grown crops, while a further 14 per cent was attributed to imported crops. Therefore, a total of 98 per cent of the embedded water in beer is attributed to crop inputs. The fact that the majority of the crop inputs to beer are sourced from within and around the Kafue Flats alone, may be a potential risk for Zambian Breweries.

³⁰ <http://www.sabmiller.com/home/stories/a-commitment-to-grow>

³¹ Ibid

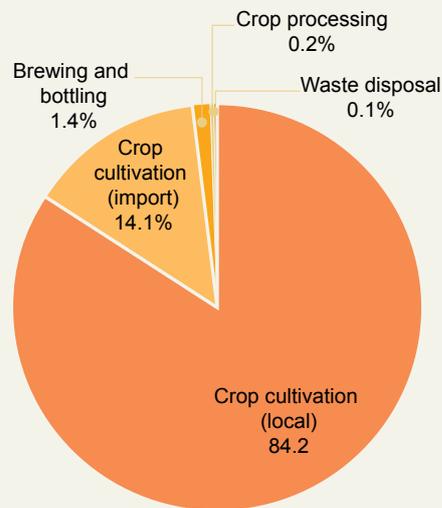


Figure 13: Water footprint across the beer value chain. Source: SABMiller

3.4. LIVESTOCK PRODUCTION

Livestock production in Zambia has the potential to increase commercially with beef production expanding across the country.

In Zambia, the majority of cattle are not kept for beef. Only 240,000 animals are slaughtered annually, accounting for just 8 per cent of the national herd. Of the animals slaughtered through the formal beef market (abattoirs), 85 per cent are supplied by traditional farmers; commercial cattle farmers account for the remaining 15 per cent. Even with the large number of cattle in Zambia, the country is a net importer of beef, due to the high demand.

In the Kafue Flats, cattle may represent 30 to 40 per cent of the households’ productive assets (the national average is 20 per cent). Six per cent of smallholder household income is represented by cattle. This may be as much as 45 per cent in livestock-dominant areas³².

The average farm gate price for beef in the Kafue Flats ranges from ZMW16,000 (US\$1,400) per tonne (Namwala) to ZMW16,500 (US\$1,300) per tonne (Monze)³³. Therefore, if 10 per cent of the herd in the Kafue Flats is slaughtered annually, the total earning for beef for the region equates to approximately ZMW3.2 billion (US\$265 million).

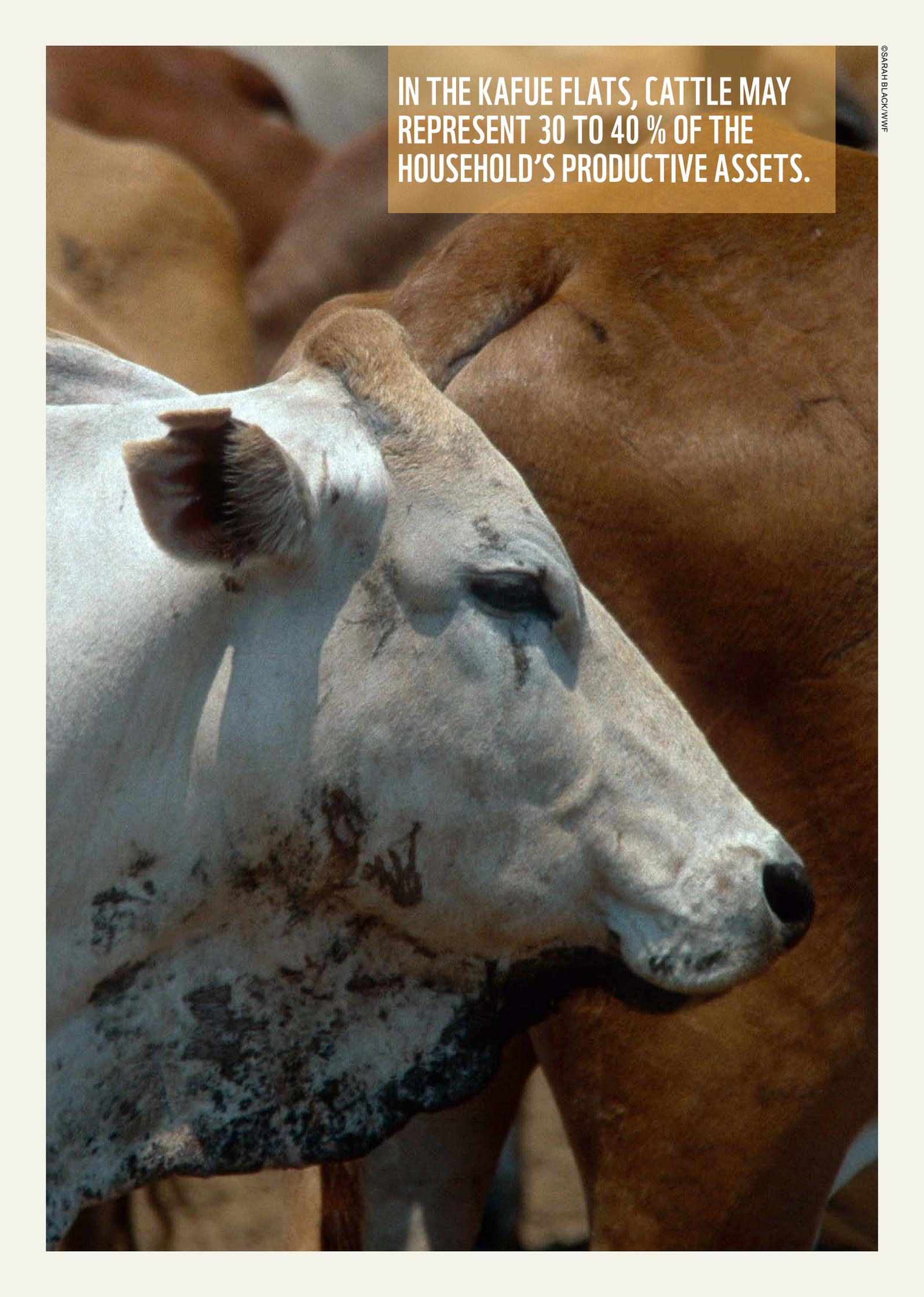
Zambeef³⁴

Since its incorporation as a small-scale start-up business, Zambeef has become one of Zambia’s largest agri-businesses with annual revenues of approximately US\$255 million, and currently employs over 5,500 staff. Zambeef was listed on the Lusaka Stock Exchange in 2003.

³² Indaba Agricultural Policy Research Institute; Smallholder Livestock Production and Challenges in Zambia, 2013

³³ <http://www.farmprices.co.zm/index.php%3B>

³⁴ <http://www.zambeefplc.com/>



IN THE KAFUE FLATS, CATTLE MAY REPRESENT 30 TO 40 % OF THE HOUSEHOLD'S PRODUCTIVE ASSETS.

Edible oils and beef account for 23 per cent of Zambeef revenue, while stock feed account for 11 per cent, and crops 8 per cent. The remainder is from chicken, pork, bakery products and flour, dairy, fish, leather, West African meats, and its ZamChik Inn fast-food chain.

Major activities carried out by Zambeef include beef, cropping, chicken and eggs, milk and dairy, pork, edible oils, stock feed, mill and bakery, leather and shoes and palm products.

Milk production has room to grow in Zambia

There is major growth possible in the Zambian dairy sector, with a current annual growth rate of 10 per cent taking place. Currently, 10 per cent of the national herd is used to produce milk for formal markets. This equates to approximately 100,000 cattle. The national average milk yield is low due to the prevalence of traditional cow breeds being used. Major growth is taking place with the increase of milk collection centres in the Kafue Flats and other regions where livestock density is high.

Parmalat and Finta Danish Dairies Limited have the largest processing capacity in the country. Each have an installed capacity to process 120,000l per day. However, their output levels are far lower. Other major dairy firms include ZamMilk (a division of Zambeef) and Diamondale. Dairy processors in Zambia are facing a shortfall in the supply of raw milk due to a growing domestic demand for dairy products. They are not utilizing their current processing capacity to its full potential. Most processors are below 59 per cent capacity utilisation (ACF, 2012). Processors' demand for raw milk has increased in recent times and has resulted in a dependence on milk powder imports to compensate for the deficit. This also puts pressure on Zambia to allow imports of cheaper and poor quality fresh milk from other countries³⁵.

Parmalat and the Milk Collection Centres (MCC)

Parmalat Zambia is the largest dairy processor in the country in terms of output. It employs approximately 240 people and operates at 40 per cent capacity, producing 50,000l of milk per day. Parmalat processes half of the raw milk produced in Zambia (of which 70 per cent comes from 24 commercial farmers). Approximately 8 per cent of their annual milk purchases come from small-scale dairies working under cooperative schemes. Many of these smaller operations are backed by donor funding.

Because the demand for milk and milk products far outweighs supply, Parmalat imports milk powder which is then reconstituted into 200,000l of milk per annum. Recognizing the shortage of supply, Parmalat is beginning to tap into the smallholder potential for milk production in traditional livelihood or beef cattle areas.

3.5. FLORICULTURE

Floriculture is a fast growing sector near Lusaka.

The production of flowers (floriculture) is one of the fastest growing export industries in Zambia. The industry includes cut and summer flowers, mostly composed of roses or flowers such as amaranthus, atriplex and euphorbia. The sector has immense growth potential in terms of production expansion and value addition, foreign exchange earnings generation, employment creation and contribution to overall socio-economic development. However, as indicated throughout this report, water

³⁵ <http://www.lrrd.org/lrrd25/4/mumb25073.htm>

is in demand, and there may be potential trade-offs needed regarding water supply. Under present circumstances, challenges regarding refrigeration, water supply and transport costs need to be mitigated before the industry can expand.

Flower exports amount to approximately US\$40 million worth of roses per year. This value dropped (to US\$27 million) due to the slowing of the economy in 2009. The main export markets for flowers in 2009 included the Kingdom of the Netherlands, the United Kingdom and Germany. Other markets include South Africa, Denmark and Niger.

An important element of flower exporting is a secure supply chain, with the fresh flowers kept refrigerated and disease-free as they are moved from the farm to markets in Europe within 48 hours. Therefore, the majority of flower cultivation takes place near the Lusaka airport, which falls within the Kafue catchment. Most of these flowers are irrigated through abstraction from groundwater.

3.6. THE FOOD AND BEVERAGE INDUSTRY

The food and beverage industry offers opportunities for small growers to leave the risks of subsistence farming.

Considering the aforementioned climate change risks facing the smallholder and often primarily rain-fed industry, an opportunity exists for the agricultural sector to begin supporting those whose livelihoods are vulnerable. Supporting the growth of an already expanding sector such as agri-business is one such solution. For instance, out-grower schemes help small-scale farmers gain access to markets, while there is also a technology transfer from large-scale farmers. Zambia Sugar is one such company. It obtains 30 per cent of its throughput from larger private growers, while 10 per cent is from small-scale farmers. In turn, small-scale growers receive training, extension services and benefits from technology transfers³⁶.

Other examples of agri-business include livestock production and providing linkages to the dairy, beef and leather industries. For instance, in an effort to improve and increase the production of milk and milk products within Zambia, companies such as Parmalat have invested heavily in increasing their production capacity. Alongside their infrastructure expansion, companies are also investing in milk collection centres in areas where there is a high density of livestock. As indicated in the figure 14, many of the milk collection centres are situated in the Kafue Flats. Previously, these areas have not harvested milk for commercial reasons due to the lack of access to markets. The investment in refrigerated collection centres enables a market for fresh milk to exist. In addition, as traditional breeds of cattle are kept in the Kafue Flats due to their value for status and hardiness against disease, they are not high producers of milk. Therefore, private companies are also said to be investing in artificial insemination for the traditional cattle breeds in a hope to improve yields.

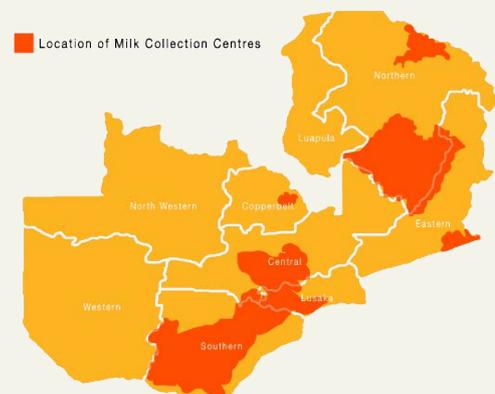


Figure 14: Location of milk collection centres in Zambia

³⁶ African Economic Outlook: Zambia. AfDB, OECD, UNDP, 2014

The majority of beef in Zambia is also sourced from traditional farmers, with the bulk being in the Kafue Flats. Therefore, both the milk and beef industry have a potential role to play in supporting livelihoods in the Kafue Flats, in the form of developing agro-processing value addition.

A small niche in the fruit and vegetables industry also provides potential for expanded development. The Zambia Export Growers Association assists farmers who grow vegetables and flowers to export their products to Europe. Farmers lump their products together through storage facilities provided by the association, which later handles the transport and marketing of their products to Europe and other markets.

3.7. SUMMARY OF UNDERLYING RISK DRIVERS TO AGRICULTURE AND FOOD & BEVERAGE INDUSTRY IN THE KAFUE FLATS

The underlying pressures for agricultural production include the loss of productivity or a decrease in the area under cultivation. In terms of productivity, negative drivers may include a decrease in water allocation for irrigation, or variability as a result of climate change. There are a number of factors influencing productivity, in addition to those associated with water, such as the use of fertilizer.

In terms of the area under cultivation, the reliability and price of electricity may also be a barrier to the expansion of irrigation. Currently, there is a gap in the supply of energy in Zambia, where the majority is used by the mining and domestic industry. As a result, any expansion of irrigation needs to consider the supply of energy in great depth.

The consequences of a drop in agricultural production range from a decrease in food security domestically, to a decrease in foreign exchange earnings due to reduced exports. The agro-processing industry, including beverage companies such as SABMiller or Coca-Cola, may also be negatively affected as a result of reduced agricultural production from the Kafue Flats.

Finally, agriculture is a major source of employment within the Kafue Flats. If production drops due to stagnation in the industry, employment will also drop. This has a compounding negative effect on people whose livelihoods are already vulnerable due to climate change and access to services, for example.

For agricultural production, the institutions involved in managing the underlying drivers and pressures include the Ministry of Agriculture and Livestock through its mandate to increase the resilience of the agriculture sector, and the Water Resource Management Agency through the allocation of water resources. ZESCO also plays an indirect role through its challenge of providing adequate access to electricity.

The consequences of a stagnating agricultural sector have a range of impacts, including reduced employment. Ultimately, these economic and social development impacts are of concern to the Ministry of Agriculture and Livestock, the Ministry of Trade and Industry and to the Treasury of Zambia.



© MARTIN HARVEY / WWF

Irrigating sugar cane fields. Sugar cane farms rely heavily on water from the Kafue River for irrigation, and effluents from sugar-cane processing are discharged back into the river. Rich in nutrients this causes plant growth (Water hyacinth) which clogs up waterways. Local people have problems navigating the river and fish suffocate. Kafue Flats, Zambia.

4. HYDROPOWER DEPENDENCY AND THE KAFUE FLATS

4.1. ELECTRICITY GENERATION IN ZAMBIA

Electricity in Zambia is mostly generated from hydropower.

Zambia has high hydropower potential, holding 40 per cent of all water resources in the Southern African Development Community (SADC)³⁷. Its hydropower resource potential is estimated at 6,000MW. However, the installed capacity is only 1,760MW³⁸. In terms of electricity generation, hydropower represents 99 per cent of state-generated electricity. The hydropower stations are operated by ZESCO (formerly known as the Zambia Electricity Supply Cooperation Limited), a state-owned power company. ZESCO is the largest power company in Zambia, producing 80 per cent of the country's current usage. ZESCO represents Zambia in the Southern African Power Pool and owns seven hydropower stations (with a combined power of 1,752MW) and one thermal power plant (8MW).

The Kafue Gorge Dam produces 990MW of power for the grid in Zambia, representing half of total production. In an effort to secure a stable water supply, two dams have been constructed in the Kafue Flats. The Itezhi-Tezhi reservoir, 250kms upstream of the Kafue Gorge, acts as the main water storage system, and has 6,000 MCM storage capacity at full supply level and the Kafue Gorge Reservoir of 900 MCM at full supply level. These two dams are the largest within the broader Kafue River catchment.

Kafue Gorge hydropower generation represents a significant proportion of water abstraction in the basin. As the operating body, ZESCO holds the largest water right in the Kafue River for abstraction to generate hydropower. However, although a large amount of water is abstracted for power generation, this is not a consumptive use of water, and is available for other users downstream once released. According to the permit database, the license for water abstraction held by ZESCO equates to 6,623 MCM per year, although in 2012, ZESCO used 8,195 MCM that year³⁹. A further 1,676 MCM per year are lost due to evaporation from the Itezhi-Tezhi and Kafue Gorge dams. This amount indicates the consumptive use of hydropower, rather than the non-consumptive use of water that is released downstream of the hydropower turbines.

An adequate hydrological flow for the generation of hydropower is critical. This is especially so in terms of the quantity of water. However, findings have shown that due to poor water quality, the water hyacinth has infested the river, causing a blockage in the turbines for energy production. Therefore, both the quantity and quality of water are important factors requiring attention for power generation.

Hydropower generation is sensitive to variations in rainfall and temperature, and climate changes may lead to two types of consequences in connection with dam operations. For instance, a change in the timing of rainfall may result in changes in the operating rules of the dam. Also, an increase in temperature may increase evaporation, causing head levels to drop and reducing the generation capacity of the Kafue Gorge power station. As the operations of the Itezhi-Tezhi change, rural livelihoods and the ecosystem functioning of the Kafue Flats will become strained.

37 http://www.ruralelec.org/fileadmin/DATA/Documents/06_Publications/Market_intelligence/AEEP_Zambia_Power_Sector_Market_Brief_EN.pdf

38 [http://unstats.un.org/unsd/environment/envpdf/UNSD_UNEP_ECA%20Workshop/Session%2008-4%20Energy%20Statistics%20in%20Zambia%20\(Zambia\).pdf](http://unstats.un.org/unsd/environment/envpdf/UNSD_UNEP_ECA%20Workshop/Session%2008-4%20Energy%20Statistics%20in%20Zambia%20(Zambia).pdf)

39 GIZ Kafue Water Demands and Infrastructure, 2013

Therefore, Zambia's reliance on hydropower to meet current and future electricity demand faces three types of challenges:

- Increased economic development leading to a growing demand for water for other uses;
- The potential for increased water needs to address conservation goals in light of the potential impact of climate change and climate variability on water supply and evaporation;
- Increased power demands requiring additional water for hydropower put a further risk on the available water in the Kafue River basin.

4.2. OPPORTUNITIES IN HYDROPOWER

There are opportunities to increase production of hydropower generation in Zambia.

There is a significant deficit in power supply nationally. The supply of electricity ranges between 1,700 and 1,800MW, while the demand ranges from between 1,800 and 1,900MW, resulting in power deficits of approximately 165MW and 200MW. Previously, 431MW was exported from the Kafue Gorge power station to Zimbabwe and South Africa. However, due to the steadily increasing energy demand within Zambia, and the rehabilitation work being done on the main hydropower stations, energy exports have been curtailed.

The electrification rate in Zambia is 22 per cent (only 3.5 per cent in rural areas). Electricity use per capita per year is 771KWH. The growth in electricity access is 0.5 per cent of the population per year. The growth in power demand is 4 per cent of the population per year. The rate of power outages represents 49.8 days per year. The private sector's reliance on self-generation is estimated at 19.5 per cent of its power consumption.

The grid has high losses of 22 per cent, of which distribution losses account for 12 per cent. In addition, although revenue collection in 2011 was high (96.5 per cent), the cost recovery (39.1 per cent) was very low due to non-reflective tariffs. Zambia has one of the lowest electricity tariffs in Africa. The World Bank estimates that underpricing and the related subsidies cost the country US\$152 million a year. Total hidden costs were estimated at 93.3 per cent of revenue.

All of the petroleum used within Zambia is imported, forming a major portion of the country's import bill. The majority of petroleum is used for the transport sector (53 per cent) followed by the mining sector (27 per cent). There is a single petroleum refinery in Ndola.

Coal deposits in Zambia are estimated at over 30 million tonnes, while coal resources are estimated to be several thousand tonnes. The main coal company, Maamba Colliers, currently mines the largest share of coal in Zambia, which is used primarily by the mining industry (54 per cent) and commerce and industry (37 per cent). The contribution of coal to the total energy balance has been steadily declining over the past few years due to a decrease in investment.

Finally, hydropower provides the majority (99.4 per cent) of electricity in Zambia. This contributes about 14 per cent of total energy use. The hydropower stations supply the national grid while the diesel power generating plants supply isolated loads mainly in remote areas not connected to the grid. The gas turbines, located on the Copperbelt, provide a standby supply to the mines for example.

“Hydropower provides 99.4% of electricity in Zambia.”

4.3. THE MINING SECTOR

The mining sector represents the major portion of electricity consumption in Zambia.

Figure 15 shows the different users of electricity in Zambia. Mining is the major consumers of electricity accounting for 68 per cent, followed by households which use 19 per cent. The agriculture and forestry sector uses the least amount of the country’s electricity. Industry (other than mining) and commerce’s electricity demand is estimated at 4 per cent. Copperbelt province, due to the mining, remains the area with the highest energy consumption, representing more than half of Zambia’s total electricity demand. Mining is also the largest single contributor to the Zambian economy, representing 15 per cent of the National GDP and 70 per cent of the total export value.

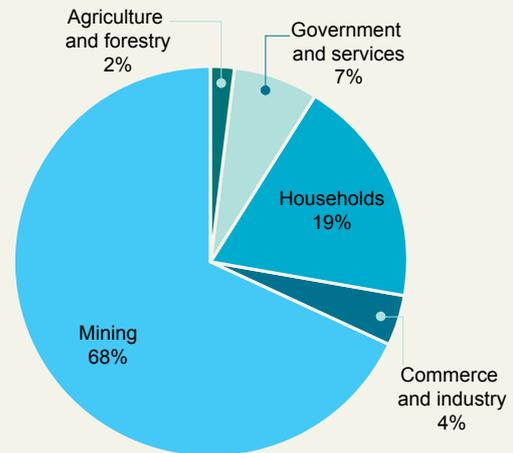


Figure 15: Proportion of electricity consumption in Zambia by user group

4.4. ELECTRICITY CONSUMPTION IN THE KAFUE FLATS

Although a major portion of electricity production takes place within the Kafue Flats, very little energy is consumed within the area.

Half of all hydropower energy produced in Zambia stems from the Kafue Flats. However, 60 per cent of all electricity produced in Zambia is used by the mines in Copperbelt province.

In 2004, according to a national household survey, 83.4 per cent of the households in Zambia depend on wood resources for their cooking energy⁴⁰. Only 16.2 per cent have access to electric energy for cooking. In rural areas however, about 97.9 per cent of the households depend solely on wood resources for their cooking energy, while only 1.7 per cent have access to electrical energy. In urban areas, 60.4 per cent of the households depend on wood fuel, most of which is charcoal. The most urbanized provinces of Lusaka and Copperbelt are the highest in terms of electric energy as a source of cooking energy, at 40.2 per cent and 37 per cent respectively. The rest of the provinces have less than 10 per cent of their households with access to electricity for cooking⁴¹.

The rural districts of the Kafue lag behind in terms of access to electricity. Only 8 per cent of the population in Namwala, which is located on the border with Itezhi-

⁴⁰ [http://unstats.un.org/unsd/environment/envpdf/UNSD_UNEP_ECA%20Workshop/Ses-sion%2008-4%20Energy%20Statistics%20in%20Zambia%20\(Zambia\).pdf](http://unstats.un.org/unsd/environment/envpdf/UNSD_UNEP_ECA%20Workshop/Ses-sion%2008-4%20Energy%20Statistics%20in%20Zambia%20(Zambia).pdf)

⁴¹ Ibid.

Tezhi and which has felt the full ecological and social impact of the dam being built, had access to electricity for lighting in 1996. Compare this with the 65 per cent who had access to electricity for lighting in Chililabombwe, while all urban districts had more than 44 per cent of their population accessing electricity for lighting (Central Statistical Office, 2000).

“The present consumption of wood fuel far outstrips the sustainable supply.”

4.5. BIOMASS ENERGY CONSUMPTION

Firewood and charcoal represent a larger portion of energy consumption than hydropower.

In Zambia, approximately 70 per cent of energy consumed by households comes from biomass, whereas 14 per cent of the Zambian population is supplied by electricity from the national grid. Energy consumption through wood fuel has shown a significant increase in the past ten years, relative to the use of petroleum or electricity sources of energy. This is due to the increase in Zambia’s population alongside an inadequate expansion of rural access to electricity.

4.6. ECOLOGICAL IMPACTS OF ENERGY PRODUCTION

There are different ecological impacts associated with biomass and hydropower production.

The impact of firewood and charcoal on Zambia’s natural environment is dire. In Zambia, half of the firewood is converted to charcoal and every year, the equivalent of 430km² of woodland is cleared to produce more than 113,660 tonnes of charcoal.

Wood is the basic fuel for 3.2 million rural households, providing approximately 68 per cent of their energy needs. Although Zambia’s rural electrification programme is reaching increasing proportions, firewood is expected to remain the dominant domestic energy source in rural areas for many years to come. Current consumption levels are estimated to be in excess of 8 million tonnes per annum. The national energy budget in Zambia is dominated by biomass, which accounts for 70 per cent of the total energy consumption of 4.33 million tonnes of oil equivalent (TOE).⁴²

In 2004, the forest sector was estimated to contribute 3.7 per cent to the country’s GDP, of which charcoal production generated the largest value added of 2.2 per cent. Firewood production accounted for 0.8 per cent and household production of timber for 0.3 per cent⁴³.

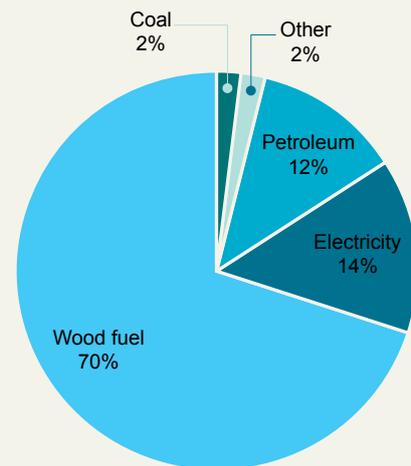


Figure 16: Total national energy demand by source

⁴² Department of Energy 1992

⁴³ SAVCOR Survey 2004 – Contribution of the forest sector to the National Economy and Poverty Reduction in Zambia

The forest sector is estimated to provide employment for 161,000 people. Charcoal production offers the largest proportion of employment at 90.4 per cent, while firewood production employs 4.2 per cent.

Wood fuels collected for the cooking of food has a detrimental impact on the forest areas of Zambia that are not protected as nature reserves. The population increase in recent years has resulted in an increasing demand for inexpensive and readily available wood fuel for energy. In the Kafue Flats, wood is collected from higher-lying areas where trees are not inundated by flooding for the majority of the year. The present consumption of wood fuel far outstrips the sustainable supply, and is of major concern to the country⁴⁴.

Hydropower dams have changed the hydrology of natural flooding in the Kafue Flats

The construction of the Itezhi-Tezhi Dam in 1971 for the storage of water for hydropower generation in the Kafue Gorge has changed the hydrology of the Kafue Flats. When built, the Itezhi-Tezhi Dam was meant to regulate the flow of the Kafue with a firm draft of 183m³/s. The allocation for constant power generation was 168m³/s, while 15m³/s was available for other unspecified users, mostly agriculture.⁴⁵

Concerns regarding the social and ecological impacts of the dam on the Kafue Flats led to the incorporation of supplementary flows within the operation rules for maintaining the agricultural and biological productivity of the area. The operating rules stipulated that ZESCO have to release a minimum of 40m³/s: 25m³/s for the maintenance of the downstream riverine habitat and 15m³/s for other water users including agriculture and urban areas.

In March 1977, there was also a four-week 300m³/s flow to provide simulated flooding. Named the 'March Freshet', the simulated flood was needed to improve the ecological functioning of the wetlands. These operating rules, termed the "SWECO Rules", were under operation from 1977 until 1994. The Itezhi-Tezhi Dam was designed with an extra 803 MCM storage capacity specifically to meet the flow requirements of the March Freshet, and is the first dam in Africa to do so.⁴⁶

Since 1994, the operating rules of the dam releases have changed in an effort to ensure minimum water levels through the year, in addition to the maintenance of adequate water levels for energy generation. The operating rules have been fine-tuned with the view of achieving a better congruence with ecological requirements, including aligning the timing of the beginning of the freshet, increasing the volume of the freshet release and increasing the flood recession area during the dry season. This is achieved by the use of real-time rainfall and water levels in the simulation models to improve river flow forecasting

The generation of hydropower is also significantly dependent on a functioning Kafue Flats system, to ensure that water resources reach the Kafue Gorge in sufficient volumes. One risk factor is the proliferation of invasive species. The high amounts of fertilizer used as well as the discharge from sugar mills has caused major eutrophication along the river, which in turn has resulted in high amounts of water hyacinth.⁴⁷ The hyacinth has had a detrimental impact on river transport and fish populations, in turn negatively impacting rural livelihoods. In addition, the hyacinth has caused blockages in the turbines of the hydropower facility downstream in the Kafue Gorge Dam.

44 Central Statistics Office: Environment Statistics in Zambia – Energy, 2007

45 Obrdlik et al., 1989

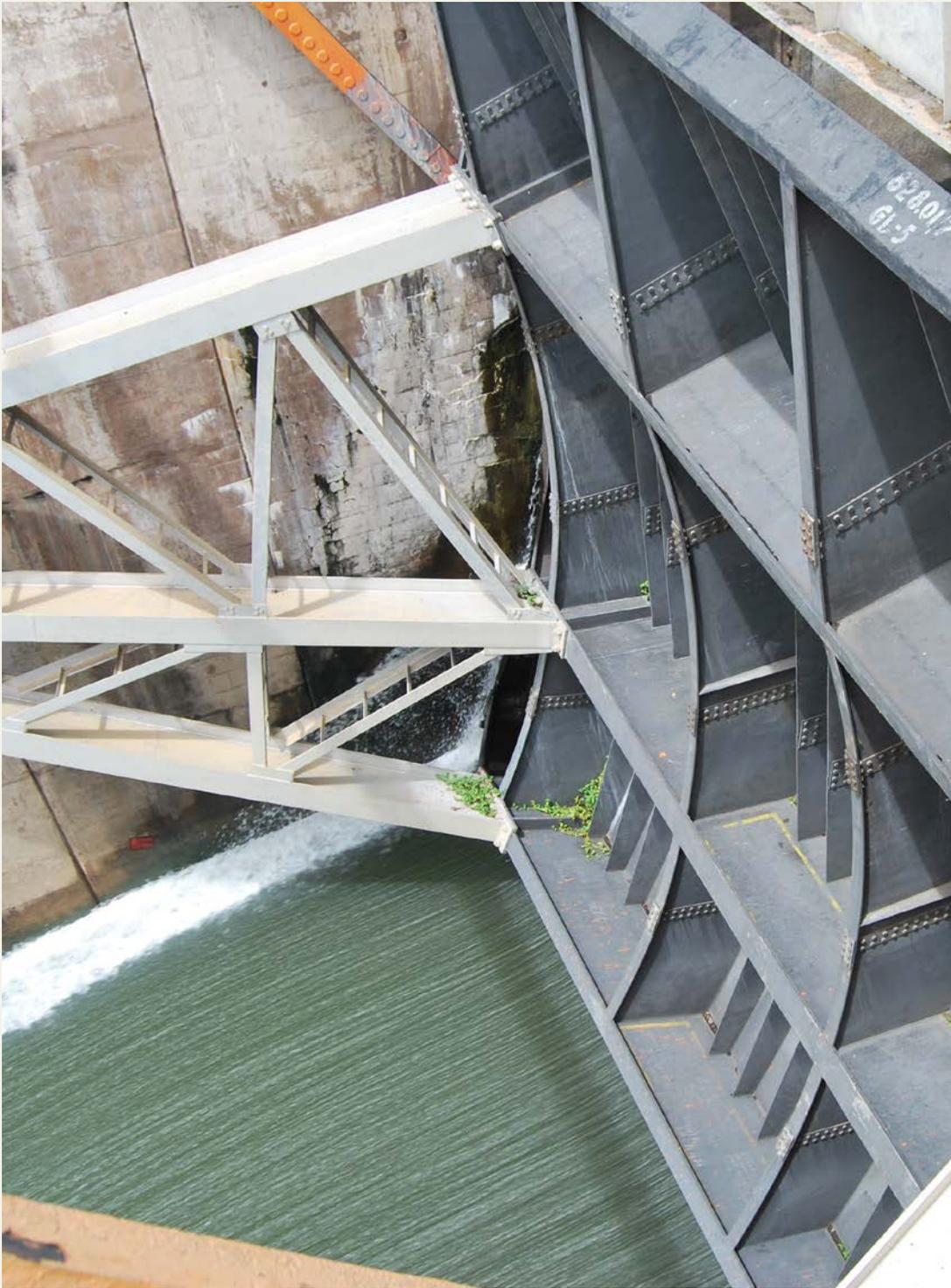
46 Itezhi Tezhi Environmental Flows, n.d.

47 Alsterhag and Petersson, 2004. Nutrient Loading in the Kafue River between Mazabuka and Kafue Town

4.7. SUMMARY OF UNDERLYING RISK DRIVERS TO HYDROPOWER GENERATION IN THE FLATS

Core pressures impacting the ability to generate hydropower include the flow regime of water through the Kafue Flats and water quality reduction through invasive alien weeds, such as water hyacinth. These pressures are influenced by drivers such as water use stress, climate change and the development impacts upstream. The Water Resource Management Authority, the Ministry of Energy and Water Development and ZESCO are the most pertinent institutions in this case.

The consequences of an unstable electricity supply in an already constrained country will be dire for key economic sectors such as mining. This will in turn negatively affect foreign earnings from the export of copper for example. Electricity consumption within Lusaka will also be negatively affected as prices will increase due to the need to import power and fuel at a greater cost. Production within urban centres such as Lusaka will also be negatively affected through a reduction in processing and industry, further impacting the GDP. These pressures are of major relevance to the treasury, mining and industry, and the Ministry of Finance and National Planning.



The Itezhi-Tezhi Dam.

5. LUSAKA DRAWS FOOD, ENERGY AND WATER FROM THE KAFUE FLATS

Lusaka is the capital and largest city of Zambia, as well as its chief administrative, financial, and commercial centre. It is a sprawling city located in a productive farming area, with a population of 1,742,000 (13 per cent of the total population) as per the 2010 census. Its population nearly tripled in the immediate post-independence era and it was considered one of the fastest growing cities (in terms of population) in Africa. The population of the broader province of Lusaka is 2,198,000.

The growth of the city can be attributed to the significant migration into the city from neighboring areas within Zambia. The city holds the lure of opportunity available through education and employment for many.⁴⁸

5.1. LUSAKA WATER DEMAND AND SUPPLY

Water supply to Lusaka does not meet the current demand

Water use in Lusaka equates to 84Mm³ a year through the Lusaka Water and Sewerage Company. Forty-four per cent of this is drawn from the Kafue, through Iolanda Water Treatment Works near Kafue town. The remainder is sourced through groundwater below the city (56 per cent). The total water use in Lusaka, including all other water suppliers, amounts to 120Mm³ per year. However, a large amount of water is lost and wasted through more than 50 per cent of non-revenue water and losses. As most of the losses through leakage occur through pipelines, it is assumed that the majority of these losses stem through the substantial pipeline transporting water from the Kafue River to Lusaka.

The demand for water in Lusaka currently outstrips the supply, as indicated in the figure 17.

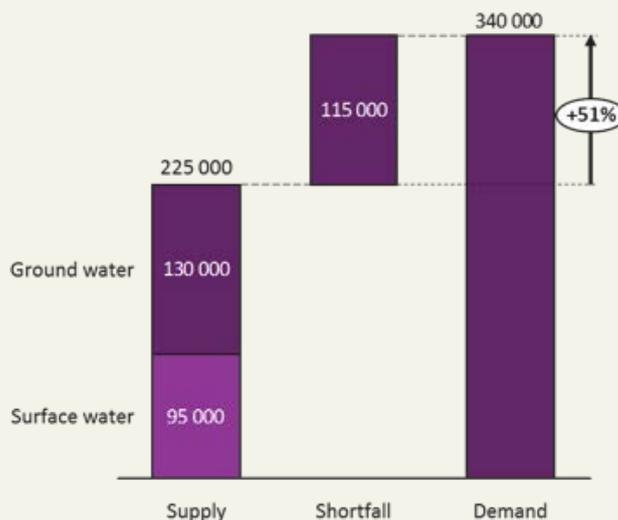


Figure 17: Lusaka total water demand and supply (m³/day)

⁴⁸ Lusaka State of the Environment Report, 2010

5.2. WATER LOSSES

A large proportion of water is lost to inadequate licensing or leakage, leading to significant revenue losses

“Most of the losses through leakage occur through pipelines.”

Although water transferred from the Kafue River is not the majority of water used in Lusaka, the catchment is indicated as a potential future supply. However, before future demand can be apportioned, water leakages and losses by the Lusaka Water and Sewerage Company need to be better managed. In 2009 for example, data obtained from its billing department estimated urban water use, including industrial and domestic, as 382 MCM per year, while the allowed allocation according to the water permits for urban water use amount to 370 MCM per year.

Based on Lusaka Water and Sewerage Company data (for October 2010), the water balance for Lusaka includes non-revenue water (NRW) that is calculated at 47.5 per cent (billed consumption/water production), while the unaccounted for water (Uf W) (which equals to losses/water production) is 47.2 per cent.

5.3. FUTURE DOMESTIC WATER DEMAND

There are significant future domestic demands for water in Lusaka

Domestic water demand in the Kafue River catchment is projected to grow to 258 MCM per year by 2020. A large proportion of this growth is due to the expansion of water supply to the Lusaka Water and Sewerage Company from the Kafue. It is estimated that abstractions from the Kafue River at Iolanda Water Works for Lusaka will increase to seven times the current abstraction of 40 MCM per year.

The Lusaka Water Master Plan Investment Strategy Report indicates the following population estimates for the city, including a doubling of the population from 2007 to 2030.

The demands for water are indicated in the following figure from the Lusaka Water Master Plan Investment Strategy. As shown, groundwater abstraction remains stable at approximately 200,000m³ per day. As a result, increased production is likely to be sourced from the Kafue River basin.

District		Population (1,000)			
		2007	2015	2020	2030
Lusaka		1,385	1,740	1,920	2,480
Lusaka adjacent area	Kafue	34	60	100	190
	Chongwe	21	40	100	160
	Chibombo	13	30	30	70
	Subtotal	68	130	230	420
Total (Greater Lusaka)		1,453	1,870	2,150	2,900

5.4. FUTURE INDUSTRIAL WATER DEMAND

Industrial water demand is also anticipated to continue growing in the Kafue River Basin

National average increases in water demand for manufacturing and mining are assumed to be 10 per cent and 7.3 per cent respectively. The increase in mining activity is evident through the increase in copper production from 440,000 tonnes in 1995 to a projected 1,456,000 tonnes in 2015. The total industrial water demand is estimated to be 474 MCM per year by 2020, a substantial increase from the current demand of 250 MCM per year. By 2015, the water demand for the national manufacturing and mining industries was said to be 163 MCM per year and 112 MCM per year respectively. According to the National Water Resources Management Plan, 75 per cent of the national manufacturing water demand is estimated to be within the Kafue River catchment, particularly in Lusaka and the Copperbelt. The national water demand for mining is assumed to be mostly within the Kafue River catchment.

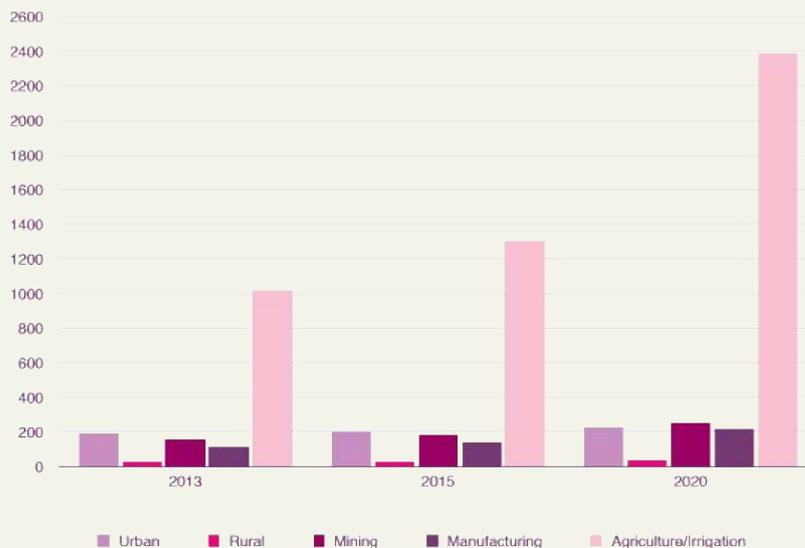


Figure 18: Projected industrial water demand in the Kafue River Catchment

An area of major industrial importance in the Kafue Flats is the town of Kafue itself. Currently, water quality concerns are a major issue for the area. The small stream of Kasenje runs through the Kafue industrial area where, among others, Nitrogen Chemicals of Zambia (NCZ), Bata Tannery, Lee Yeast, Kafue Chemicals and Kafue Textiles are located. The Kasenje stream enters the Chirumba lagoon, which is a part of the Kafue River upstream of the Kafue Railway Bridge. The town is also home to the Kafue Sewage Treatment Plant, which faces a number of challenges in ensuring adequately treated wastewater is released back into the Kafue River. Roughly 15 per cent of the town’s residential areas are connected to the sewage treatment plant, while the rest use pit latrines and septic tanks. Normally, the wastewaters from industries that lack their own facilities for purification are treated at the Kafue Sewage Treatment Plant. However, at times the pipes connecting these industries with the treatment plant are vandalized, resulting in untreated wastewater being discharged into the natural environment.

5.5. EMBEDDED ENERGY AND FOOD FOR LUSAKA

Lusaka has a large embedded energy and food footprint from the Kafue river basin

Energy, food and water are three fundamental needs of the population of Lusaka. As an urban area, Lusaka is forced to import a large proportion of food from the rural hinterland surrounding the city. Water is also transported into the city, through the pipeline from the Kafue, to augment the already stretched groundwater reserves. Finally, as the economic hub and financial centre of the country, power supply is of critical importance. Each of these needs is heavily dependent on the Kafue as a source of natural resources (especially water) for production.

Energy

Energy production is under pressure in Zambia, with data from 2005 showing a 60 per cent rise in the cost of transport fuels, while that of a 90kg bag of charcoal for cooking purposes rose by almost 90 per cent. In addition, electricity tariffs were hiked by 10 per cent in May 2005. These upward trajectories have continued as charcoal and biomass become increasingly stressed.

Within Lusaka, 54 per cent of households use charcoal, 44 per cent use electricity and the remainder use kerosene and firewood. The demand for electricity within Lusaka outstrips the city's supply. The city consumes in excess of 1,800,000Mwh, representing approximately 30 per cent of Zambia's electricity production. Some of the hydropower consumed is sourced from the Kafue Gorge Dam, while a proportion is sourced from the Kariba Gorge.

Food

As one of the closest sources of water for agriculture, a large proportion of food grown in the Kafue basin is transported to Lusaka for consumption. Vegetable farming taking place on the outskirts of Lusaka towards the Kafue is also part of the catchment, although they draw mostly groundwater for irrigation (if irrigated).

Locally grown fresh produce is an important component of the diets of many urban households in Zambia, which in most instances do not produce their own. Fresh produce accounts for 21 per cent of the food budget of urban households in Lusaka, coming second only to cereals and staples at 24 per cent⁴⁹.

Although not all of this food is sourced from the Kafue Flats themselves, it is assumed that the region plays an important role in supplying food to Lusaka, since it is the largest productive region in close proximity to the city.

5.6. SUMMARY OF UNDERLYING RISK DRIVERS TO WATER SUPPLY IN LUSAKA

Challenges to water security in Lusaka include the unreliability of water supply, water over-allocation and the poor quality of water resources. These are influenced by underlying drivers including a growing demand for water resources, climate change and upstream water users impacting the water quality. Institutions of relevance include the Water Resource Management Association, the Lusaka Water and Sewerage Company and the National Water and Sanitation Council.

⁴⁹ Central Statistics Office/MACO/Food Security Research Project Urban Food Consumption Survey (UCS) of 2007/8

6. A CONVERGENCE OF RISKS

Taking into consideration the four risk narratives, there are similarities among them regarding the underlying risks. These include:

- **Biophysical and supply risks**
- **Regulatory and institutional risks**
- **Socio-economic and financial risks**
- **Reputation and investment risks**

For instance, biophysical and water supply risks such as drought or poor water quality may negatively impact livelihoods, agriculture, hydropower and water supply for domestic and industrial use in Lusaka. In turn, biophysical risks are fundamentally mitigated and managed through regulation and institutions. Therefore, without functioning institutions, biophysical risks increase in likelihood and impact. When livelihoods, agriculture, hydropower and Lusaka city are at risk through the inadequate quality or quantity of water within the Kafue Flats, socio-economic and financial risks may arise. These may impact the economy of Zambia, depending on the scale. These risks may in turn result in reputational and investment risks for the entire country.

Without adequate environmental flow, the functioning ecosystem may decline, putting each of the sectors at further risk.

Biophysical risks range from the need to manage variability and change regarding water availability and quality. This is both seasonal and inter-year variability. Biophysical risks are also associated with climate change and an expansion in development reducing the amount of water available in the catchment. These two factors may also negatively impact water quality, as it is currently not clear what the projected increase in water needs for agriculture, hydropower, domestic and industrial use are. Abstraction of water by other users in addition to their return flow are two elements especially associated with biophysical risks in the Kafue Flats. Finally, the environmental requirements within the Kafue Flats need to be conserved and set aside. Without adequate environmental flow, the functioning ecosystem may decline, putting each of the sectors at further risk. In the case of biophysical risks, water allocation and the regulation of water resource use are key to minimizing biophysical risks.

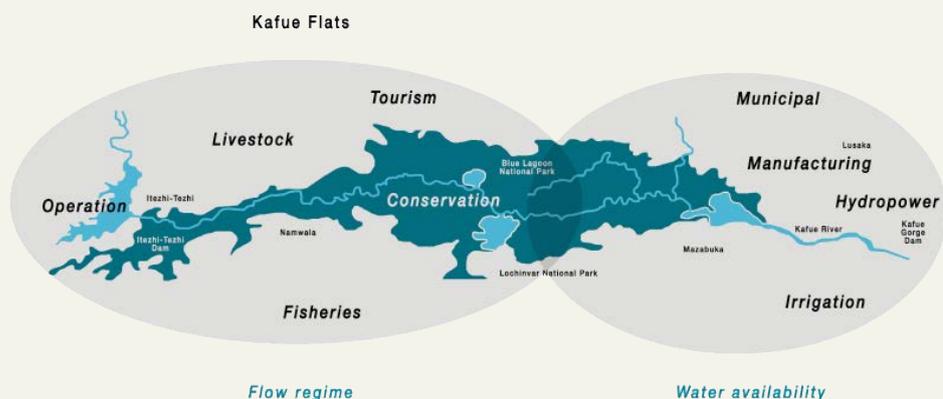


Figure 19: Flow regime and water availability: major challenges in the Kafue Flats

Finally, reputational and investment risks arise through a culmination of the previously mentioned risks. Reputational risks are especially important in the hydropower and agricultural sectors, where stable environments are required for accessing finance. A depressed agricultural sector will result in lower investments from the commercial agricultural sector, which is currently a major driving force of

the economy. As for the energy sector, if it does not provide a stable power supply, the mining sector is negatively affected as in some cases, self-generation of power becomes economically unfeasible. Due to the large investments in infrastructure for hydropower, it is paramount that a return on investment is possible. Should the mining sector not be a core user, the repayments for energy use may be less certain. Lusaka is negatively affected through a culmination of poor water supply, inadequate power supply and food insecurity. This will make the city a difficult capital to operate in commercially.

BIOPHYSICAL & SUPPLY RISKS



REPUTATIONAL & INVESTMENT RISKS



SOCIO-ECONOMIC & FINANCIAL RISKS



REGULATORY & INSTITUTIONAL RISKS



7. TOWARDS A FUNCTIONING KAFUE FLATS ECOLOGICAL SYSTEM

Further research on the optimal operating rules for hydropower generation, livelihoods and ecological functioning is needed to secure the health of the Kafue Flats.

A recent report on environmental flows in the Kafue Flats suggests the following action items to ensure further development of operating rules for dams along the Kafue Flats⁵⁰:

1. Develop models that are able to accurately predict the conditions at Itezhi-Tezhi and the inundation levels on the Kafue Flats so safe decisions can be made regarding the timing and size of the March Freshet.
2. Increase coordination of the operating rules for the two dams so less water needs to be stored at Kafue Gorge and more water can be stored at Itezhi-Tezhi.
3. Clarify roles of ZESCO as a partner (not as a controller alone) and of the Department of Water Affairs/Water Resource Management Association as a stronger regulator within a basin-wide management strategy.
4. Investigate how to mitigate the impact of the new hydropower facility being constructed at Itezhi-Tezhi to ensure a win-win solution between the government and basin stakeholders⁵¹.
5. Develop a basin protection regime that takes into consideration the trade-offs between different water needs across the Kafue Flats

The impact of the Itezhi-Tezhi Dam on the hydrograph shape is indicated in figure 20. As shown, the reduced high flows and increased low flows (from the natural state) impact different aspects of the Kafue Flats fauna and flora. A functioning ecological system in the Kafue Flats is of utmost importance to the range of sectors, lives, fauna and flora that are dependent on the direct water resource or indirect services provided by the wetland.

The functioning ecology of the Kafue Flats can therefore be recognized as an enabler to the economy of the region. However, as many aspects of the area cannot be quantified in monetary terms, the prioritization or allocation of resources for the management of the region becomes more complex. Thus, the prioritization of water users in addition to improved management of the resource is critical.

The Itezhi-Tezhi Dam flow impacts different aspects of the Kafue Flats fauna and flora.

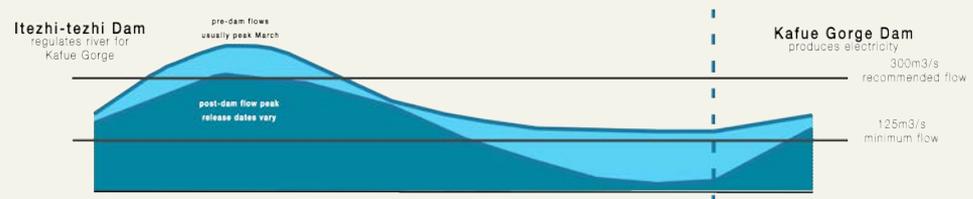


Figure 20: Impact of Itezhi-Tezhi Dam on the hydrograph of the Kafue Flats

50 King J. and Brown C. 2014. Determination of “holding” environmental flow requirements for the upper and middle Kafue River. Integrating climate change in water resources monitoring. German Technical Cooperation with Zambia Water Sector Reform Programme. GIZ

51 Ibid.

8. SUMMARY OF INSTITUTIONS AND ROLE OF THE PRIVATE SECTOR

The domestic market in Zambia is intimately dependent on production from the Kafue Flats. Therefore, one of the major stakeholders with an interest in the region is The Ministry of Finance and National Planning. The Kafue Flats situation is especially unique as it brings together ministries and departments involved in energy generation, agriculture, water supply and sanitation, livelihoods, tourism and environment. The diversity of sectors dependent on the hydrology and water allocation from the Kafue Flats is indicated in

the figure 19 above. The broad range of stakeholders poses a risk to the region as the majority function purely at a national level, without representation in the local region itself. Stakeholders operating within the region have a responsibility to ensure that resource management is supported at a local level.

In addition to the public interest of the Kafue Flats for Zambia, the region is of importance for foreign earnings through export. Private sector stakeholders with a specific interest in the area range from those with direct operations in the Kafue Flats to those with their supply chains located there. A selection of notable companies who have shared risks with other stakeholders in the Kafue are listed. This list is not exhaustive, but indicates the major retail or production companies currently operating in the Kafue Flats.

- Associated British Foods (ABF) who own Illovo Sugar, who in turn own a majority share in Zambia Sugar. Zambia Sugar is the largest sugar producer in the region, producing sugar for both domestic and export markets.
- SABMiller who own Zambian Breweries are large water users in Lusaka, but also source some of their other inputs from the Kafue Flats such as maize, barley and sugar.
- Coca-Cola Company who are large water users in Lusaka, and source some of their inputs (such as sugar) from the Kafue Flats.
- Lactalis, the majority share owners of Parmalat in Zambia, who have operations in Zambia, but also source milk from the Kafue Flats.⁵²
- The EU floriculture and horticulture industry which sources cut flowers and vegetables from companies such as Khal Amazi (90 per cent of export roses from Zambia) and York Farm Limited (vegetables for export). Retail markets such as the US, South Africa, New Zealand and Australia are also significant buyers of Zambian flowers and vegetables. Retail customers include Mark and Spencer and other large retailers of food in Europe.
- Shoprite, a South African retail chain, has a significant footprint in Zambia, with a large supply chain stemming from the Kafue Flats. Shoprite also have an agreement with Zambeef who run their butcheries. Zambeef, although Zambian, are also listed on the London Stock Exchange. These companies source a large amount of their foodstuffs from the Kafue Flats.

⁵² <http://www.parmalat.co.za/index.php?id=1>

9. OPPORTUNITIES FOR MANAGING THE WATER RESOURCES OF THE KAFUE FLATS

9.1. PARTNERSHIP AND COLLECTIVE ACTION

Managing the competing water needs and challenges within the Kafue Flats will require strong and innovative partnerships on water. The Kafue Flats harbours one of the highest degrees of multi-sectoral water-users in Zambia. Therefore, with so many competing demands, it is clear that data to support informed discussions and decisions about water allocation and use is critically needed. This forms

the basis for managing competing water demand, as Zambia becomes an emerging economy. Thus, prioritizing action on water is essential to the economy and well-being of Zambia.

In this context, the private sector interest stems from a need to maintain markets and direct profits, in addition to building or maintaining a positive image. Businesses have begun to recognize that the public sector may suffer from inadequate financial resources, inadequate institutional capacity and inappropriate governance mechanisms to support growth and mitigate risks. The Kafue is precisely such an example. Without an adequate action plan to mitigate these risks, all water users in the region face challenges going forward.

Collective action is a response to these deficiencies, as it intends to bring together the relevant actors around the common goal of improved water management and identify actions at river basin scale that can be implemented in an innovative partnership approaches. Through the inclusion of a multi-stakeholder group, fresh ideas and perspectives can be generated. Moreover, having numerous partners also brings credibility and legitimacy to the process, while the additional resources available increase the momentum for change.

While government holds the water management mandate and does everything possible to improve matters in this regard, the current capacity for water management is inadequate to manage the water needs of all users. The private sector can offer insights, urgency and resources where appropriate and water users can contribute by implementing actions on the ground. This is also suited to the private sector, as they are able to respond to global trends of engagement outside the “factory fence”.

As this study shows, the connection to water for business has significant implications. Since the private sector generates jobs, income, economic development and foreign exchange, these business risks need to be better managed. In particular, Lusaka city could greatly benefit from a partnership with other major users within the Kafue Flats in an attempt to optimize water needs from the catchment. Similar arrangements could be beneficial for the Copper Belt and downstream communities. The potential for creating a sense of shared ownership of the issues can help manage water with clear benefits. Some benefits of collective action include:

- Clear articulation of problems, shared ownership of solutions, clarity of joint purpose
- More informed decision-making by business and other stakeholders
- Broader scope and depth of motivation and momentum in support of water-related improvements
- An expanded pool of expertise, capacity, or financial resources focused on fostering change

- More durable outcomes that are supported by the engaged parties
- Establishment of trust and maintenance of credibility and legitimacy with critical interested parties
- Stronger water governance by engaging multiple stakeholders, including all water users

Collective actions focusses on the added value that the different actors can bring to the table and thus requires new forms of working together around a public good such as water. The interests of the private sector, when working in collaboration, represent a paradigm shift from lobbying and opposition to cooperation and partnership.

The process of corporate engagement in water policy does not happen without first managing water internally, within the “factory fence”. WWF have proposed a number of “Stewardship Steps” for companies as they begin to act collectively with stakeholders within a catchment. The Stewardship Steps are indicated below, with the final two steps highlighted, where companies are encouraged to engage externally in partnership to ensure efficiencies are being met, as opposed to only engaging internally.

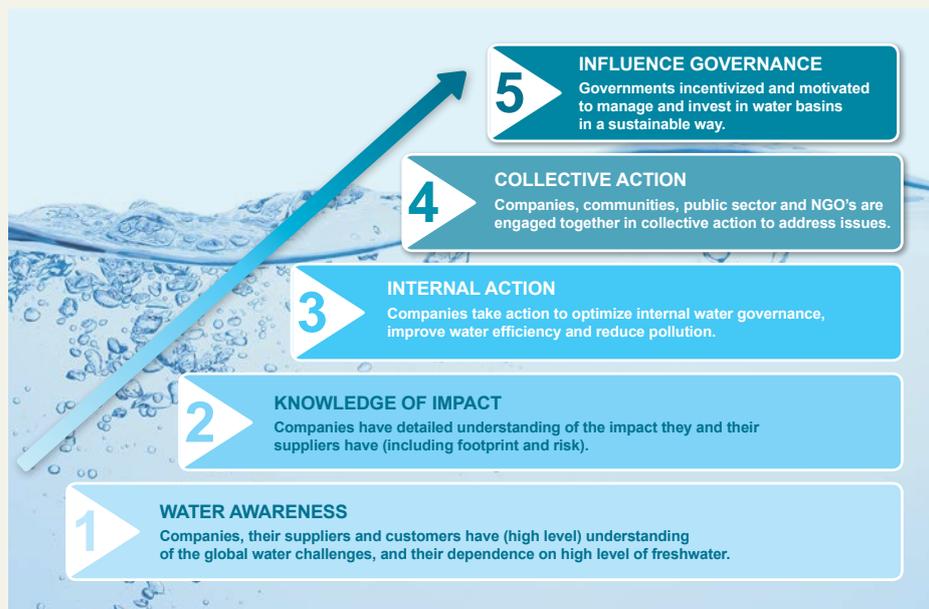


Figure 21: WWF water stewardship steps

9.2. CALL TO (COLLECTIVE) ACTION IN THE KAFUE FLATS

Over the last year, key stakeholders including civil society, private companies and government institutions, have come together in an effort to better understand the risks facing the Lower Kafue sub-basin and to search for opportunities to address some of the challenges. It started with WWF convening a meeting with a number of stakeholders to approach water from a more holistic perspective and assess more explicitly the role of water in the Zambian economy. The result is this report which is particularly a joint effort of this group of stakeholders and which tries to layout the water risks and opportunities in the Kafue Flats.

As part of the process of gathering information on the risk narratives WWF Zambia brought together key stakeholders including the private sector, public sector, government and civil society organisations (CSOs) to discuss the initial findings. There was a strong willingness by the group to work collectively to address the risks highlighted within the study and as a result they have developed the Kafue Flats Joint Action Group (KFJAG). Through this collective action process, a joint action plan has been created to ensure that conflicting water use requirements are managed cooperatively.

The enthusiasm of this group to be committed water stewards was made clear. To advance water management in the Kafue Flats the KFJAG will promote an ambitious water agenda. The collective actions will be determined by stakeholders over time, but so far they include the following activity types:

- Water (use, flow, quality) information collection, management and sharing
- Water allocation planning, implementation and enforcement
- Sectoral water management plans (Lusaka groundwater, irrigation agriculture, electricity production)
- Promote and increase water efficiency of several key sectors from urban water supply to agriculture
- Support Water Resources Management Agency in researching and managing water resources.

9.3. FINAL WORD

Water stewardship initiatives and private sector interest in water are on the rise globally. A decade of work, much of it involving WWF, has raised the profile of water and its connections to the corporate bottom-line. We have explored accounting tools, risk analysis, valuation, collective action, strategy, partnerships and guidance – all aimed at capturing and supporting company actions on water. We do this because no matter where we work, the private sector is there. Either in production, supply, or investment – we cannot separate our objective of preserving nature without engaging business interest and economics.

The intention of this work and process is not to replicate what is already known. Rather it is to pair water science with economics - to frame water use in risk terms that resonate with decision-makers. We believe that in the Kafue, we now have a great opportunity to demonstrate how water stewardship can work in practice and how this area can be a showcase for many other places in Africa and the world.



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The Kafue River and flats.

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*As at March 2016

Kafue Flats in numbers

45%

The Kafue Gorge dam accounts for 45% of total hydropower production in Zambia

44%

The Kafue River supplies 44% of Lusaka's domestic and industrial water

1 MILLION

Almost 1 million people depend directly on the Kafue Flats for their livelihoods

1 CLICK

The WWF Water Risk Filter can be accessed at: <http://waterriskfilter.panda.org>



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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