Chapter 5.Focus and perspectives

This focus section complements CropWatch analyses presented in chapters 1 through 4 by presenting additional information about topics of interest to global agriculture. Chapter 5 presents a focus on disaster events (5.1), updates on the Southern hemisphere (5.2), an overview of the agricultural and environmental settings in the Zambezi Basin (section 5.3), and an update on El Niño (5.4).

5.1 Disaster events

The three major disasters that affected 2015 can probably be listed as the 7.6 magnitude earthquake that rattled Gorkha in Nepal on April 25, the heat wave in India and Pakistan in May, and the October-November floods in India. All these disasters have in common that they occurred in developing countries, and that the vast majority of lost lives and property were uninsured.

A January 2016 press release by Munich Re states that 2015 experienced the lowest insured losses of any year since 2009. Overall losses totalled US$90 billion, of which roughly US$27 billion were insured. The largest disaster in terms of human suffering was no doubt the Gorkha earthquake in Nepal in April 2015, but the costliest for the insurance sector were the North American storms of February 2015.

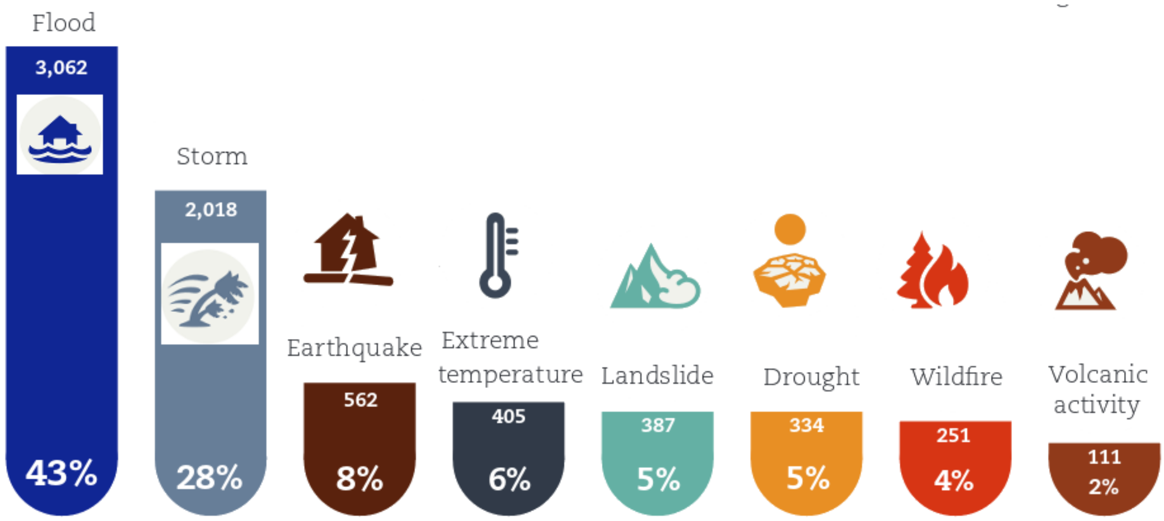
In contrast, a recent report by UNISDR prepared for the latest UNFCCC COP21 in Paris estimates the **human** costs of disasters that occurred between 1995 and 2015 and provides an alternative view to assessments by the insurance industry, where costs are mostly loss of assets and property and where losses tend to be insured losses, i.e. they are highest in wealthy countries, as illustrated above.

According to UNISDR, between the 1985-94 and 2005-2014 decades, the frequency of natural disasters increased by 14%. What has not changed, however, is the nature of the most damaging factors: floods account for nearly half of all natural disasters. Over the last 20 years they affected more that 2 billion people, mostly in Asia.

Storms are less frequent than floods, but they are more deadly: they killed about a quarter of a million people; about 90% of these were in lower-income countries, even though they experienced only half as many storms as developed countries. The economic cost of weather related disasters (close to US$ 2,000 billion according to CRED's documentation) is a clear underestimation as few impact assessments include quantitative data (less than 20% in Africa).

Overall, annual economic losses from disasters are estimated by UNISDR at between US$250 billion and US$300 billion annually. This compares with the “insured loss” of US$ 2.1 billion and the overall loss of US$2.8 billion for the “costliest natural catastrophe for the insurance industry in 2015”, the above-mentioned winter storms.

Figure 5.1: Percentage of disasters due to main geophysical factors between 1995 and 2015



Source: modified from http://www.unisdr.org/2015/docs/climatechange/COP21_WeatherDisastersReport_2015_FINAL.pdf

Earthquakes affect crops mostly indirectly, through the disruption of the social fabric and infrastructure (roads and irrigation systems). The Nepal earthquake has been remarkable in the sense that aftershocks have continued to this day, with more than 400 (with magnitudes between 4 and 5) recorded.

Other significant earthquakes can be listed for Tajikistan (7.2 magnitude on 7 December in Murghob district), Afghanistan (26 December, 6.2 magnitude), India (3 January, 6.7 magnitude in Manipur), Peru (7 January, 5.0 magnitude) and Chile (7 January, 5.6 magnitude).

A good overview of security related crises, many of them with a climatic component and almost all of them with severe short-term and long-term impacts on food insecurity, are described in a report published by the ACAPS Global Emergency Overview (GEO).

Burundi experiences a combination of civil unrest and floods that led to internally and internationally displaced people, and left many of its people food insecure in spite of favorable growing conditions in the country. The impact of flood on the food situation will take time to resorb, as illustrated by Côte d'Ivoire where by mid-December more than 200,000 people were facing a crisis (IPC Phase3)[1] as a result of drought. Similar situations exist in Nigeria and Cameroon where internally displaced people were driven from their homes by floods.

Drought

The return of large-scale drought to parts of eastern and southern Africa is one of the most serious features of the current reporting period. Affected areas include South Sudan and Ethiopia, as well as several southern African countries where the drought is the worst since 1982. In South Africa, five out of nine provinces have been designated disaster areas for agriculture (including Free State and North West, Mpumalanga and Limpopo) and more than 2.7 million households are facing water shortages across the country. In Zimbabwe, 1.5 million people will face food insecurity until March 2016 and over 850,000 people urgently require assistance. In Malawi, one of the smallest countries in the region, close to 3 million people is estimated to be food insecure. Recent estimates put the number of persons without reliable access to food in southern Africa at approximately 29 million.

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[1]For the definition of the IPC classification system, refer to http://www.fao.org/elearning/course/FI/EN/trainerresources/learnernotes0764.pdf

According to a recent ACAPS Briefing Note about south Sudan, 3.9 million people are currently classified as undergoing a food crisis (IPC Phase 3), emergency (IPC Phase 4) or catastrophe (IPC Phase 5), mainly in Jonglei, Upper Nile, and Unity States. In neighboring Ethiopia, recent estimates put the number of people in need of food assistance at more than 10 million. Most of the regions of Amhara, Oromia, and SNNPR are reported to be in crisis (IPC Phase 3) while poor households in East and West Hararghe as well as Oromia region are in emergency food insecurity (IPC Phase 4). The situation is likely to temporarily improve in areas where the main season harvest (Meher) has started, but pastoralist areas in the east are suffering most and cattle deaths have been reported. Although the Ethiopian government has taken measures to import a million tons of wheat, the number of cases of severe malnutrition cases is currently foreseen to reach 435,000 in the coming months.

Tropical cyclones

Several tropical cyclones that occurred in October were reported on in more detail in the previous CropWatch Bulletin[2]. They included Hurricane Joaquin over the Caribbean, Mujigae in the Philippines, Vietnam and China, Koppu on Luzon in the northern Philippines and, to some extent on Taiwan and Ryukyu Islands in southern Japan as well as the most powerful cyclone on record, Patricia which affected Pacific areas in Mexico but created relatively limited damage.

No additional severe cyclones occurred, except two rare events in Yemen where tropical cyclone Chapala (first days of November) has affected about 1 million people, followed on 9 January by cyclonic storm Megh which made a direct hit on Socotra Island. Both brought rain to Yemen and Saudi Arabia.

Floods

A long list of floods, including flash floods, were reported for the reporting period from all continents, including the USA (Texas on 30 October and 1 November), Spain (3 November), the Delta region of Egypt (4 November), the Red Sea coast of Saudi Arabia (19 November), Kenya (28 November), Kinshasa in the DRC (10 December), a large area over south America (Paraguay, Argentina, Brazil and Uruguay flooding in December) as well as Australia (6 January).

The most significant floods are probably those that affected Somalia, Iraq, India (Chennai) and Malaysia. South-central Somalia suffered floods in several events affecting close to 130,000 people (about half had to be relocated) from 23 October and in November. In early November 40 refugee settlements received heavy rains predominantly in Baghdad and Anbar province resulting in the death of 58 people. In Chennai and other parts of Tamil Nadu (Cuddalore), 250 people have died in due to excess water in October and November. In Malaysia a similar situation occurred, with a combined flood and landslide killed 315 people in Perak, involving Kampung Changkat Lobak, Matang Tengah and Kampung Air Hitam, on 21 November.

5.2 Southern hemisphere updates

The present section provides a concise summary of recent winter wheat harvests in the southern hemisphere, as well a first quantitative assessment of maize in South Africa, the main summer crop in the region, where prevailing drought conditions (See section 5.1 and the South Africa page in section 3.2) seriously threaten food security in several countries.

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[2]http://www.cropwatch.com.cn/htm/en/files/20151123213525951.pdf

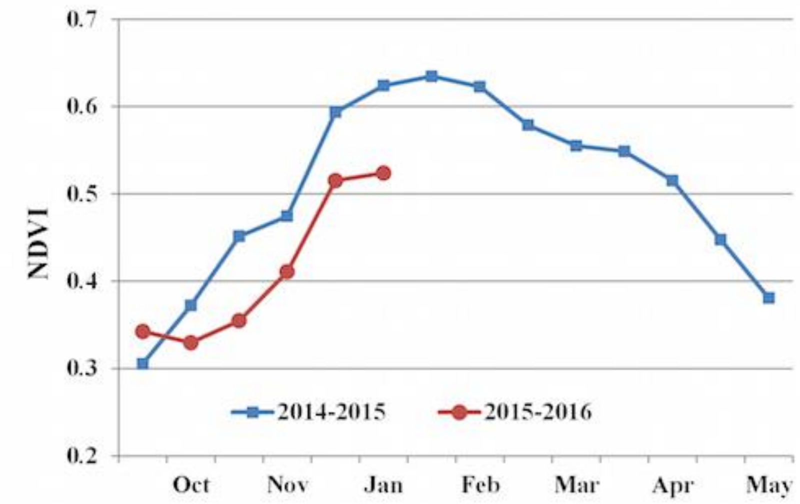
In Argentina, the updated CropWatch wheat output estimate currently stands at 10.7 million tons, 11% below the 2014-2015 production, as both harvested area and yield decreased compared with last year. Annex B lists production according to provinces: Buenos Aires and Mesopotamia (Entre Rios) both did well (+11% and +24%, respectively) while a production drop occurred in Santa Fe (-14%), Cordoba (-34%) and the rest of the country.

In neigboring Brazil wheat production is up 4.5% over last year, reaching 7 million tons. The largest increase, by state, was achieved in Santa Caterina (+20%), a relatively minor producer, and in Rio Grande do Sul (+13%). In Parana, production fell 12%.

For Australia CropWatch puts the overall output at 25 million tonnes, 1% below last year. The regional breakdown is as follows: New South Wales, +5%; South Australia, -7%; Victoria, +7% and Western Australia, -3%.

Figures 5.2 and 5.3 illustrate a detailed analysis of the current situation of maize in South Africa

Figure 5.2: Development of NDVI profiles over maize growing areas in 2014-15 and 2015-16



The average NDVI (Figure 5.2) is currently more that 0.1 units below the corresponding value in 2015. Figure 5.3 indicates a considerable reduction of the cultivated area in otherwise significant producer provinces (Free State, North West and Limpopo). Based on low yields (down 16% from last year) and reduced cultivated area (-34%), CropWatch estimates that the total maize output of South Africa will drop from 13.2 million tons to 7.3 million tons, a 45% reduction.

Figure 5.3: Relative distribution of maize in 2014-15 and 2015-16

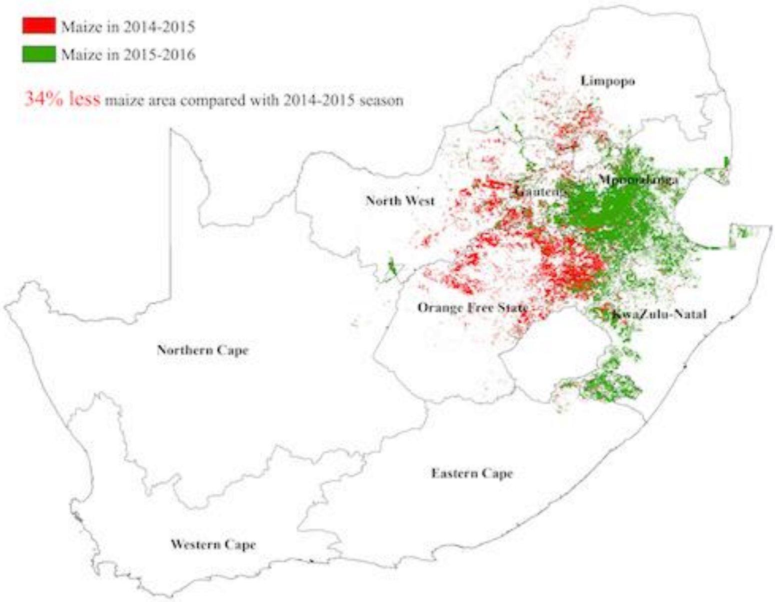


Figure 5.3 shows both red and green areas that grew maize in January 2015. In January 2016, only the green area had living maize crops.

5.3 The Zambezi basin[3]

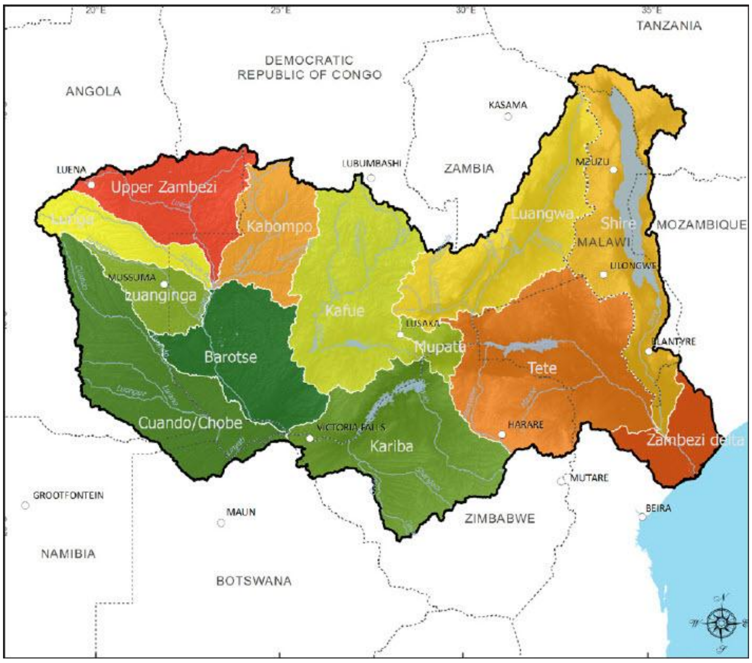
The Zambezi River is the largest river system in southern Africa and the fourth longest on the continent. Together with its tributaries, it flows through eight countries, namely Angola, Botswana, Namibia, Malawi, Mozambique, Zambia and Zimbabwe (Figure 5.4) and has two major man-made dams, Lake Kariba and Cahora Bassa dam as well as the famous Victoria Falls (Figure 5.5).

The river is vital to the livelihoods of many citizens of these countries as it provides hydropower and water for urban, industrial and agricultural sectors. However, due to the steep terrain and poor soils along much of the river, few irrigation schemes have been developed except for those in the lowland flood-plain in Mozambique.

The dams (built in 1958 and 1969) have also changed the pattern of water flow, and thus the agricultural practices, which were traditionally dependent on the seasonal flooding bringing both water and silt to the fertile flood plains. The natural vegetation is described as a basis for the livelihoods of the people, followed by the importance of agriculture to food security and the conservation areas to tourism. An estimation of the vulnerability of these systems to climate change gives a view of the pressures affecting the people and the need for consideration of climate variability during agricultural development.

[3] Contributed by Professor Sue Walker, Emeritus Professor of Agrometerology, Dept Soil, Crop & Climate Sciences, Univ. Free State, Bloemfontein, South Africa and Honorary Professor, School of Biosciences, University of Nottingham Malaysia Campus, Semenyih, Malaysia

Figure 5.4: The Zambezi basin in southern Africa



Source: SADC/SARDC and others, 2012

Figure 5.5: Victoria Falls from the Zambian side

a. Dry season (July 2009) b. River before the falls

Source: Sue Walker, 2016

Natural Vegetation

The Zambezi River rises out of a swampy (*dambo*) riparian *miombo* (Brachystegia) shrubland at 1524m North West of Mwinilunga, in the North-western Province of Zambia (UNESCO, 2016) and flows eastwards to the Indian Ocean forming a delta at its mouth at Quelimane in Mozambique. The basin covers an area of 1,390,000 km^2 with its tributaries (Figure 5.4). It is 2,574 km long flowing through eastern Angola, forming the border between eastern Namibia and northern Botswana, then becoming the border between Zambia and Zimbabwe and finally to Mozambique, where it flows through Tete, Sofala and Zambezia provinces to empty into the Indian Ocean (Figure 5.4). At the delta the dominant vegetation, often flooded, is open grassland-dominated savanna including palm, mangrove and dune forests (Hogan, 2012).

The People

The Zambezi basin is home to more than 40 million people, with about 7.5 million residing in the urban centers. This makes up about a third of the total population of the countries (SADC/SARDC and others, 2012). There are a wide range of population densities between countries across the basin, with Malawi being the most densely populated country and Zambia being the least densely populated. There are also large areas that are not inhabited, as they are reserved for wildlife conservation and tourism. As the basin covers most of the land area of Malawi, > 90% of the 14.9 million people live within the basin. For both Zambia (76% of county in basin) and Zimbabwe (55% of county in basin) about 65% of the total population of each country (13.09 million & 12.57 million) lives within the Zambezi Basin, so it is of vital importance to the national economy. The wetlands and lakes (especially Lake Malawi/Nyasa/Niassa, the Zambezi delta/Sofala bank, Cahora Bassa dam, Itezhi-Tezhi, Kafue and Lake Kariba) also play an important role, as fish contributes to the people's source of protein for food security.

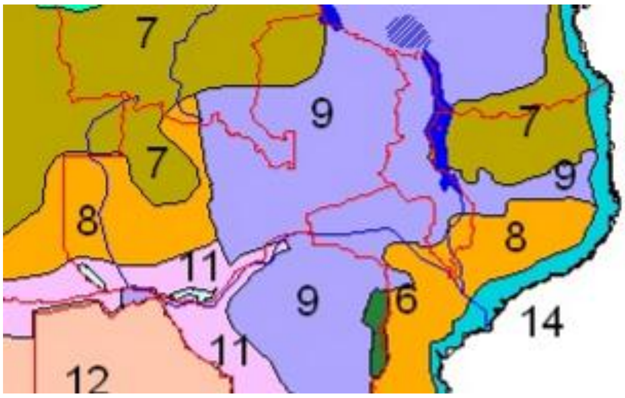
In the Zambezi basin, food security is at the heart of the people's livelihoods as there are many smallholder farmers producing food for local consumption mostly under rain-fed farming systems described below. In order to achieve this, a concerted effort needs to be made to intensify the agricultural production using sustainable techniques, while maintaining an agro-ecological perspective that will balance the available natural resources with the crop production requirements (IFAD, 2010).

Agriculture

The main farming systems (Figure 5.6) in the Zambezi Basin are rain-fed mixed maize systems (#9 in Figure 5.6) including livestock (FAO, 2016). These are mostly managed by smallholders who plant maize after ploughing with animal traction after the first rains at the beginning of the summer growing period in October and November (Figures 5.7 and 5.8).

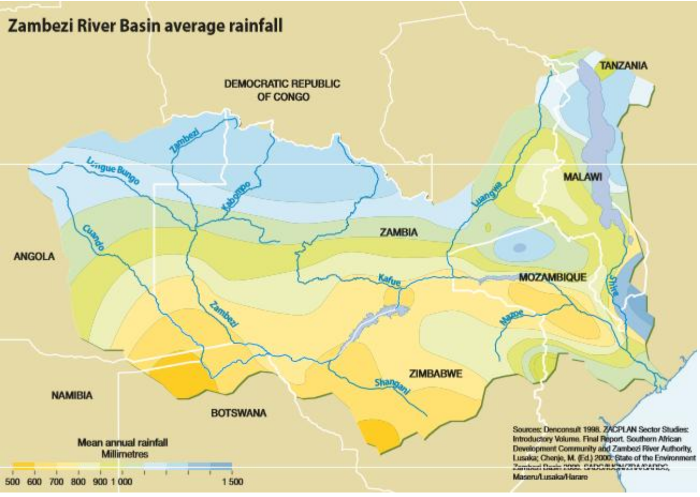
There are also small pockets of commercial agriculture, cereal-root crop mixed systems (#8 in Figure 5.6) and agro-pastoral systems with sorghum and millet (#11 in Figure 5.6). Generally speaking the farming systems follow the latitude and rainfall patterns (Figure 5.7), as the growing season is limited to the rainy season. Thus the main system of mixed maize (#9 in Figure 5.6) stretches from southern Zimbabwe with 475 mm/y and 90-120d growing season through the middle of Zimbabwe and into Zambia where the rainfall is above 700 mm/y and the growing season is longer than 150d (Figures 5.6 and 5.7). Further north towards Lake Malawi where the rainfall can reach 1400 mm/y and the growing season can stretch to more than 180d, mixed maize systems (#9 in Figure 5.6) are still common (FAO, 2016). Agro-pastoral systems (#11 in Figure 5.6) dominate the south-western regions (< 500mm/y) and the steep ravines along the edges of Lake Kariba and Cahora Bassa dam, which are areas also suffering from severe land degradation.

Figure 5.6: Farming systems variation across the Zambezi basin countries



Note: 6 = highland temperate mixed; 7 = root crops: 8 = cereal-root crop mixed; 9 = maize mixed: 11 = agro-pastoral millet/sorghum; 12 = pastoral; 14 = coastal artisanal fishing, (FAO, 2016)

Figure 5.7: Average annual rainfall distribution across the Zambezi basin



Source: SADC/SARDC and others, 2012

Figure 5.8: Ploughing a field with animal traction ready to plant maize in southern Zambia

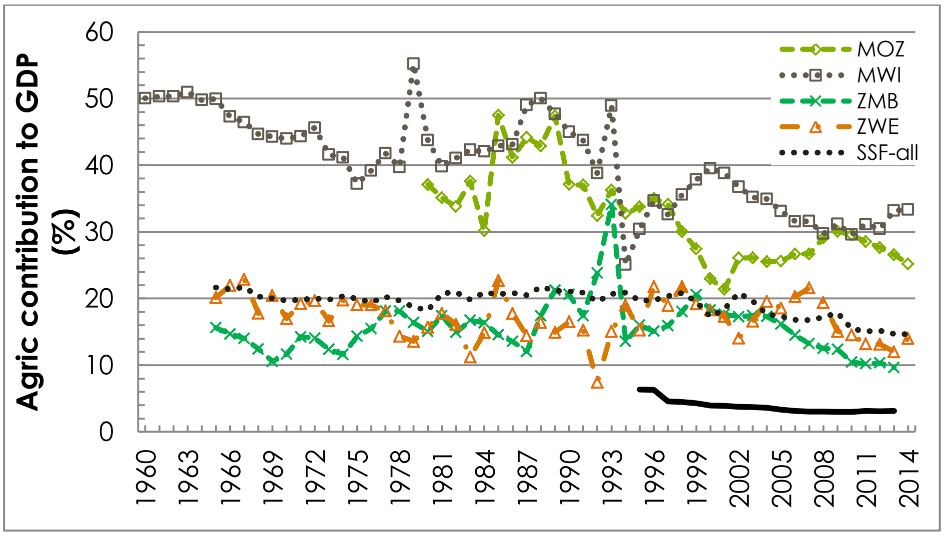
Source: Sue Walker, October 2006

Agriculture plays important role in the sustainable economic development in most of the Zambezi basin countries. Although the contribution of agriculture to GDP (Figure 5.10) has been declining over the past decades as the countries have developed, it remains at 33.2% for Malawi, 26.6% for Mozambique, 12.0% for Zimbabwe and 9.6% for Zambia compared to the world average of 3.1% in 2013 (World Bank, 2016). Zimbabwe, Zambia and Malawi together cultivate 86 % of the estimated 5.2 million ha of land in the basin annually (SADC, 2016). The water from the Zambezi has multiple uses as it flows through the basin (Figure 5.9). Besides agriculture and fisheries, the potential for hydropower has also been developed. The hydropower from the Zambezi river generates approximately 5000 MW, with Cahora Bassa (2 075 MW), Kariba (1 470 MW) and Kafue Gorge (990 MW) dams providing the bulk of the basin's hydropower electricity (SADC/SARDC and others, 2012).

Figure 5.9: A young farmer preparing for a simple irrigation system; and goats drinking from a well; both near Monze, Southern Zambia

Source: Sue Walker, October 2006

Figure 5.10: The contribution of agriculture to GDP (Gross Domestic Product) in main countries of Zambezi basin

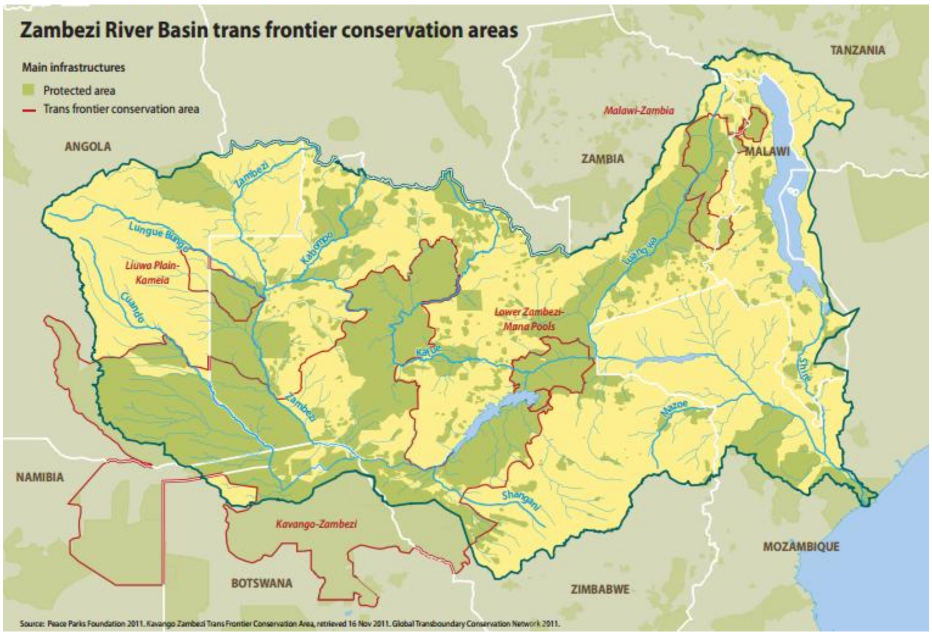


Note: MOZ=Mozambique, MWI=Malawi, ZMB=Zambia, ZWE=Zimbabwe, compared to average from all sub-Saharan African countries (SSF-all) and world mean (World Bank, 2016).

Conservation Areas

There are many areas in the basin that are protected as wildlife parks and forestry areas (Figure 5.11). This includes a number of trans-frontier parks and conservation areas as well as UNESCO declared Biosphere Reserves and two UNESCO World Heritage Sites, namely Mana Pools, and Sapi and Chewore Safari Areas. The trans-frontier parks are (a) Liuwa Plains - Mussuma, (14 464km^2) between Angola and north western Zambia; (b) Kavango - Zambezi where Angola, Botswana, Namibia, Zambia and Zimbabwe converge (approximately 520 000 km^2 including 36 national parks, game reserves, community conservancies and game management areas); (c) Lower Zambezi – Mana Pools (17745 km^2) between Zambia and Zimbabwe; and (d) Malawi - Zambia in the north east. This international recognition is an indication that the Zambezi basin is rich in biological diversity worth preserving. Within its basin are wetlands, aquatic systems, riverine woodlands, Afro-montane forests, dry forests and savannas which are all complex ecosystems which support abundant wildlife and a great diversity of trees and plants; with some species native only to the Zambezi region (ZamSoc, 2016). There are also twenty RAMSAR wetland sites across these countries, the main ones within the basin being Zambezi Flood Plains in the upper region, Lukanga Swamps and Kafue Falls in central Zambia, and Luangwa Floodplains in the north east (SADC/SARDC and others, 2012).

Figure 5.11: Trans-frontier conservation areas in the Zambezi basin



Source: Peace Parks Foundation, 2011

Estimation of Vulnerability

Many people in the Zambezi basin are vulnerable to food insecurity. Causes for their food insecurity include poverty, irregular income and food supply, brought about by limited access to markets (poor infrastructure), as well as the effect of weather variability on food crop production. Variability will be exacerbated by climate change and thus these people can become even more susceptible to food insecurity.

Within the Zambezi Basin, the combination of sensitivity and exposure give highest impact areas in parts of both Zimbabwe and Malawi, followed by parts of Mozambique and Zambia. For the overall vulnerability analysis, areas of Mozambique and Malawi emerged as 'hotspots', with parts of Zimbabwe and Zambia rated as intermediate (Davies et al., 2010). These indices can then also be estimated for future time periods using selected parameters from Global Climate Models, showing that this methodology has promise for application with a range of future scenarios.

Conclusion

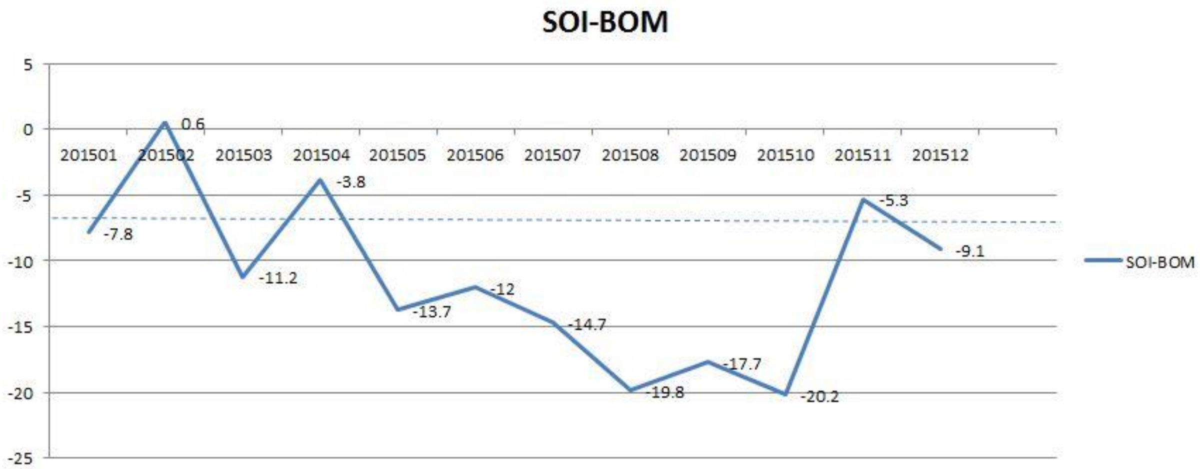
From this overview its rich natural and human resources demonstrate the potential for development in the Zambezi basin. Opportunities for development can be based on sustainable environmental development of the water and land resources by their ability to generate income from both farming and tourism. Agricultural development needs to balance the supply of water and demands of the environment with the desires and needs of the people for improved livelihoods using the natural resources available to them. However, attention must be given to transport and marketing infrastructure as well as viable adaptation strategies with intensification of agricultural practices under the variable climatic conditions.

5.4 El Niño

In spite of a declining trend during the current monitoring period, the strong El Niño still persists. CropWatch monitored the following typical climate anomalies associated with El Niño events: positive temperature anomalies in Northeast China and SouthAsia, negative precipitation anomalies in North Australia and maritime Southeast Asia, drought in central and northern South America, positive precipitation anomalies in Argentina and Peru, and especially drought in southern Africa.

Figure 5.12 illustrates the behavior of the Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from January 2015 to December 2015. Sustained negative values of SOI below -7 generally indicate an EI Niño event, while sustained positive values above +7 are typical of La Niña. Values within the range (-7 to +7) indicate neutral conditions. During the current season, SOI has increased to -5.3 in November 2015, indicating a declining trend.

Figure 5.12. Behaviour of the Southern Oscillation Index (SOI) from January-December 2015



NASA reports the gradual weakening trend of El Niño through spring 2016, and the possible transition to ENSO-neutral conditions during late spring or early summer.