WATER and ENERGY for FOOD

ASSIST-WE4F Deliverable #2

Water Accounting Sustainability Framework and Zambezi River Basin Dashboard

Submitted to WE4F

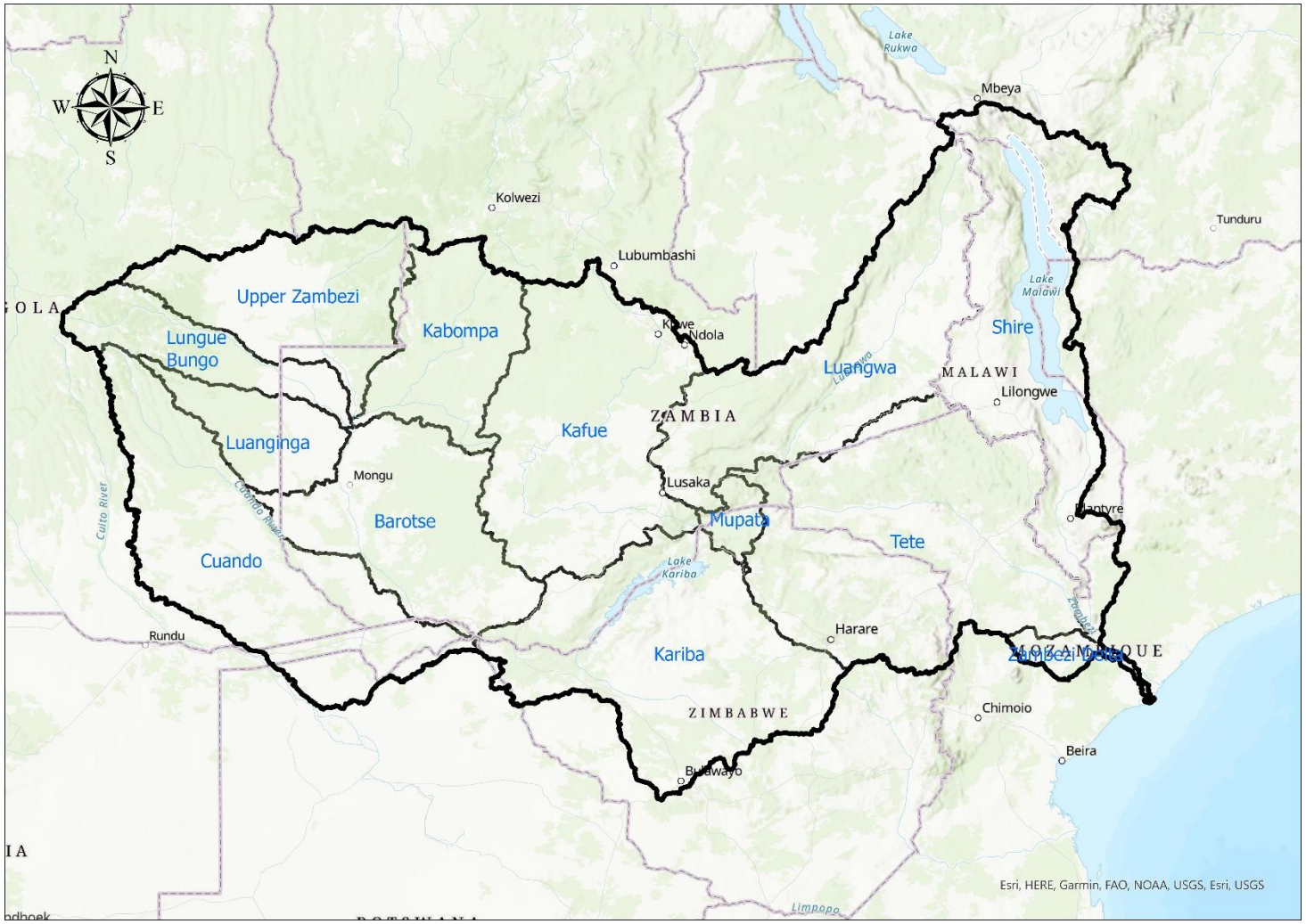
International Water Management Institute

german cooperation DEUTSCHE ZUSAMMENARBEIT
Government of the Netherlands
Norad
Sweden Sverige
USAID FROM THE AMERICAN PEOPLE

Introduction and Background

- The Zambezi is the fourth longest river in Africa and is the largest in Southern Africa.
- The Zambezi Basin has a total drainage area of approximately 1.4 million Sq. Km (Beilfuss, 2012).
- The mainstream originates from Kalene Hills in the North-western Province of Zambia and has a total length of 2,574 km.
- The river plays a central role in the economies of eight riparian countries namely Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe.
- The basin waters meets the basic needs of app. 30 million people and sustains a rich and diverse natural environment.
- The key economic activities in the basin are agriculture, fisheries, mining, tourism, and manufacturing.
- Industry is dependent on hydroelectric power, which is the main source of energy
- Other sources of energy are primarily coal and oil.

Study Area



- Rainfall varies in the basin but is generally higher in the northern regions (500-1400mm)
- Basin is highly sensitive to climate variability
- Population is unevenly distributed

The Problem

- The Zambezi Basin is poorly gauged and is comprised of several competing water users.
- The basin is home to over 30 million people (Beilfuss, 2012) with a rapidly growing population which ensures increased demand for water resources and the various ecosystem services they provide
- No clear definition of stress for sub-basins despite a number of competing water users and a fast-growing population
- Few instances of water accounting based on the SEEAW and these were done at national level for Botswana (MMEWR, 2016) and Zambia (MWDSEP, 2020)
- Requirements are often unavailable or based on long term and expensive monitoring activities (Karimi, 2013; MWDSEP, 2020)
- Current water accounts have no link to LULC

Objectives

1. Quantify water available changes in Zambezi river basin and establish a baseline conditions (2003-2021) and future scenarios (2027-2045) using remote sensing observations and water accounting plus (WA+) framework.
2. Using the WA outputs, quantify indicators of water availability and change for baseline and future scenarios.
3. Generate water availability layers that will be used as inputs into ASSIST-WE4F.

Determination of Hotspots and Stressed Sub-catchments – Past and Future

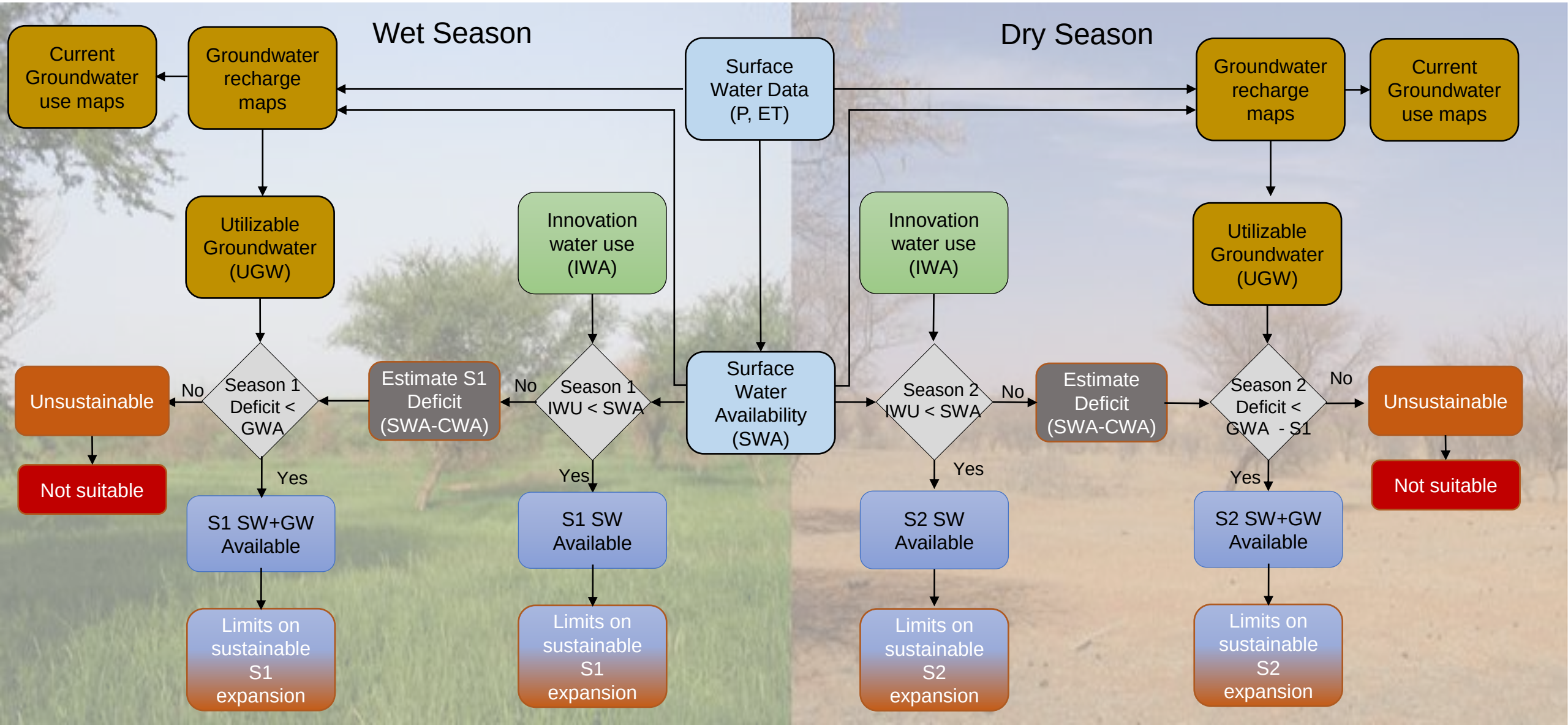
- Use of time-series WA+ information for each sub-catchment.
- Use of blue and green ET data to understand irrigation water use.
- Use of different GCM to produce future WA+ sheets.
- Determine future stress points.

Sustainability Framework, Analysis and Results

Sustainability Framework

- Sustainability framework analysed surface water and ground water availability
- Wet and dry season analyses
- Considered different crops and their water requirements
- Assessed possible expansions of innovations

Sustainability Framework - Chart



End-User (crop) Water Use (Zambia)

Country	Innovation type	Crop water use (m3/ha)
Zambia	Solar Dryer	
Zambia	Battery stick kit/ULVA+ sprayer	319.5 m3/ha
Zambia	Soil restoration for food conservation and market	Soybeans - 400-500 (rainfed) Soybeans - 500-600 (humid) Groundnuts – 400-500 (rainfed) Groundnuts – 500-600 (humid) Gliricidia – 300-500

Innovator	End-User Location	Country	Latitude	Longitude	Innovation type	Innovation_area (H	Crop/Product type	Innovation_start date	Innovation_end date	Crop_wateruse (m3/ha)
COMACO	Chipangali	Zambia	-13.988	32.448	Soil restoration for food, conservation, and markets	1752	Soybeans, Grounduts and Gliricidia	May-22	Oct-24	Soybeans: Estimated water use for soybeans in Zambian conditions under conservation agricultural practices: Rainfall-Dependent Areas: Approximately 400 - 500 m3/ha More Humid Regions: Approximately 500 - 600 m3/ha Groundnuts (Peanuts): Estimated water use for groundnuts in Zambian conditions under conservation agricultural practices: Rainfall-Dependent Areas: Approximately 400 -
COMACO	Katete	Zambia	-14.042	32.058	Soil restoration for food, conservation, and	1492.5	Soybeans,Organic Grounduts,cowpeas and Gliricidia	May-22	Oct-24	
COMACO	Chipata	Zambia	-13.632	32.653	Soil restoration for food, conservation, and	3419.5	Soybeans, Grounduts and Gliricidia	May-22	Oct-24	
COMACO	Mambwe	Zambia	-13.95	31.95	Soil restoration for food, conservation, and	2171.25	Soybeans, Grounduts and Gliricidia	May-22	Oct-24	
COMACO	Kasenengwa	Zambia	-13.69	32.083	Soil restoration for food, conservation, and	562	Soybeans, Grounduts and Gliricidia	May-22	Oct-24	
COMACO	Sinda	Zambia	-13.984	32.223	Soil restoration for food, conservation, and	766.5	Soybeans, Grounduts and Gliricidia	May-22	Oct-24	
Solar Village	Mwandami	Zambia	-15.01705	27.15132	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	0
Solar Village	Moonga 2	Zambia	-15.05494	27.16512	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Chimoto	Zambia	-14.9847362	27.0205555	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Mukokomena	Zambia	-14.616622	27.3776981	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Nalusanga	Zambia	-14.9499787	26.7230332	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Ndinenka	Zambia	-14.93267	27.05956	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Lukutaika	Zambia	-15.09401	27.01705	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Mikando	Zambia	-14.71479	27.04528833	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Chibuluma	Zambia	-15.12975	26.89137	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Munyati	Zambia	-14.98744	27.06279	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Shimalungwe	Zambia	-14.75716167	27.11955	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Kayata	Zambia	-14.74786667	27.06783	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Mukombo	Zambia	-15.04064	26.95283	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Masumba	Zambia	-14.71362833	27.042095	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Shakalo	Zambia	-15.06389	27.03082	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Solar Village	Ndolobaki	Zambia	-15.1024	27.15547	Battery stick Kit/ULVA+ sprayer	7.5	Groundnuts and Tomatoes	22 June 2022	30 June 2024	319.5
Syiva Food Solutions	Mabele	Zambia	-15.332	28.67	Solar Dryer		Vegetables and seeds	22 June 2022	10-Apr-23	
Syiva Food Solutions	Moono	Zambia	-15.715	28.006	Solar Dryer		Vegetables and seeds	22 June 2022	10-Apr-23	

End-User (Crop) Water Use (Zimbabwe)

Country	Innovation type	Crop water use (m3/ha)
Zimbabwe	Logistics/Information/Marketplace	NA
	Biodigester	??
	Solar Water Pump	20-25??

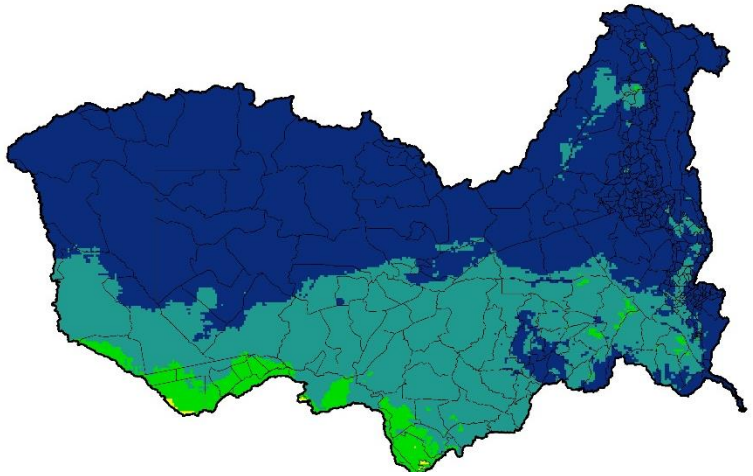
Innovator	End-User Location	Country	Latitude	Longitude	Innovation type	Innovation_area (H	Crop/Product type	Innovation_start date	Innovation_end date	Crop_wateruse (m3/ha)
Farmhut	Mashonaland Central	Zimbabwe	17.5080S	30.9757	Logistics As A Service	1	Horticultural Crops	2022	Ongoing	
Farmhut	Midlands	Zimbabwe	19.4657S	29.8124	Information Services	0,9	Horticultural Crops	2022	Ongoing	
Farmhut	Mashonaland East	Zimbabwe	17.6502S	31.7787	Marketplace	1	Horticultural Crops	2022	Ongoing	
Lanforce	Seke	Zimbabwe	18.0770'S	30.8039'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Marondera	Zimbabwe	18.1885'S	31.5487'E	Biodigester	20	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Gokwe	Zimbabwe	18.2175'S	28.9422'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Shurugwi	Zimbabwe	19.6771'S	29.9769'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Zhombe	Zimbabwe	18.6767'S	29.3497'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mt Darwin	Zimbabwe	16.7764'S	31.5767'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Buhera	Zimbabwe	19.3211'S	31.4399'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Makoni	Zimbabwe	18.1828'S	32.0837'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Zvimba	Zimbabwe	17.4626'S	30.4358'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Victoria Falls	Zimbabwe	17.9316'S	25.8302'E	Biodigester	15	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mvurwi	Zimbabwe	17.0278'S	30.8556'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Harare	Zimbabwe	-17.8540800	31.139514	Biodigester	16	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Domboshava	Zimbabwe	17.6118'S	31.1432'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mashonaland east (Goromonzi)	Zimbabwe	17.8550'S	31.3757'E	Biodigester	20	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mashonaland east(SEKE)	Zimbabwe	18.0770'S	30.8039'E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mashonaland east (CHIVHU)	Zimbabwe	18°15'57."S	30°49'04.2"E	Biodigester	2	Maize and Vegetables, Zvipfuyo		ongoing	
Lanforce	Mashonaland east (HWEDZA)	Zimbabwe	18.6167'S	31.5667'E	Biodigester	20	Maize and Vegetables, Zvipfuyo		ongoing	
Zonful Energy	Shamva	Zimbabwe	17.2980'S	31.5653'E	Solar Water Pump					
Zonful Energy	Mazowe	Zimbabwe	17.5080'S	30.9757'E	Solar Water Pump					
Zonful Energy	Seke	Zimbabwe	18.0770'S	30.8039'E	Solar Water Pump					
Zonful Energy	Beatrice	Zimbabwe	18.2493'S	30.8556'E	Solar Water Pump					
Zonful Energy	Gutu	Zimbabwe	19.6442'S	31.1580'E	Solar Water Pump					
Zonful Energy	Bindura	Zimbabwe	17.3041'S	31.3274'E	Solar Water Pump					
Zonful Energy	Beatrice	Zimbabwe	18.2493'S	30.8556'E	Solar Water Pump					
Zonful Energy	Chegutu	Zimbabwe	18.1380'S	30.1474'E	Solar Water Pump					
Powerlive	Mugangavani Village Mhondoro	Zimbabwe	-18.57122934	30.67722021	Solar Water Pump	1	Tomatoes, vegetables	2022		25
Powerlive	Chegutu Mash West	Zimbabwe	-18.13320681	30.14521692	Solar Water Pump	1	Vegetables, Tomatoes	2022		25
Powerlive	Chivhu	Zimbabwe	-19.008699	30.890238	Solar Water Pump	1	Maize, vegetables	2023		25
Powerlive	Domboshava	Zimbabwe	-17.610917	31.200927	Solar Water Pump	2	Poultry, piggery, fish	2023		20
Powerlive	Eastview Phase 6	Zimbabwe	17°49'28.0"S	31°14'25.0"E	Solar Water Pump	0.2	Vegetables	2023		25
Powerlive	Dema	Zimbabwe	-18.064722	31.208377	Solar Water Pump	0.6	Potatoes. sweet potatoes	2023		25

Potential Crop Types and Water Requirements

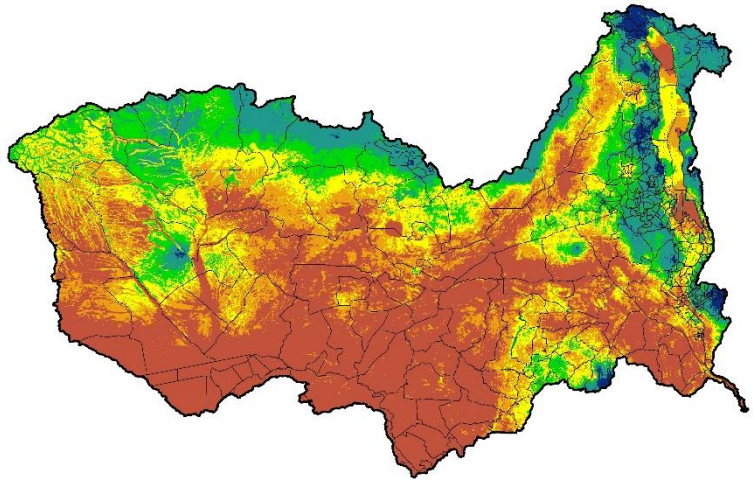
No	Vegetable	Water requirement		Water requirement category
		mm/season	mm/day	
1	Cabbage	500-800	3-5	High
2	Chicory	466-600	2-4	Medium
3	Lettuce	400-600	2-4	Medium
4	Leek	400-600	2-4	Medium
5	Carrot	400-600	2-4	Medium
6	Onion	400-600	2-4	Medium
7	Garlic	400-600	2-4	Medium
8	Pea	300-500	2-4	Low
9	**Tomato**	400-600	2-4	Medium
10	Bean	400-600	2-4	Medium
11	Chilli	300-500	2-3	Low
12	Cucumber	500-700	3-5	High
13	Eggplant	500-800	3-5	High
14	Okra	500-700	3-4	Medium
15	Pumpkin	500-800	3-5	High
16	Groundnuts	400-600	3-5	Medium
17	Soybeans	400-700	4-5	High
18	Maize	500-800	6-9	High
19	Potatoes	500-700	4-5	Medium
20	Sweet Potato	500-1000	8-12	High

Surface Water Availability

Wet Season P (mm/season) (Nov –Apr)

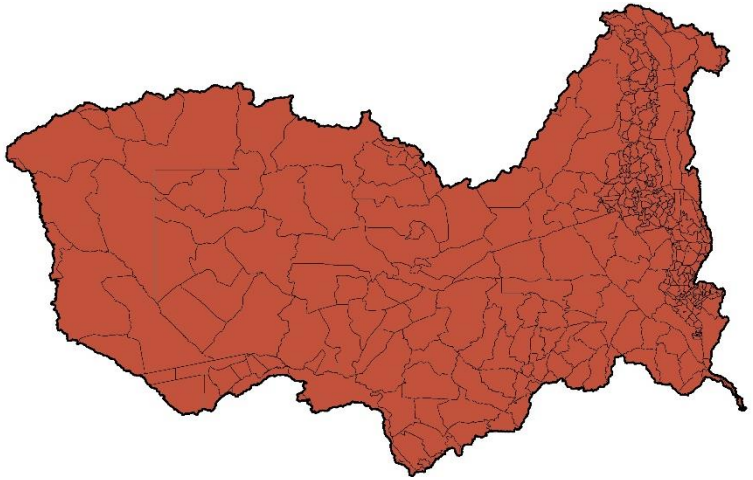


Wet Season P-ET (mm/season) (Nov –Apr)

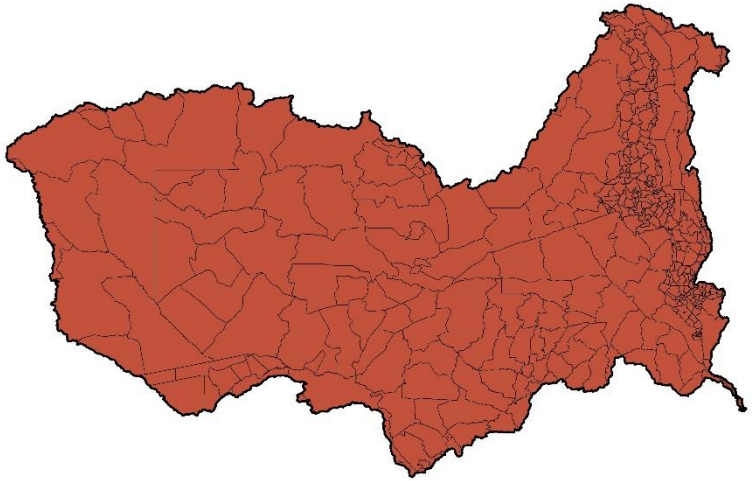


season sum in mm
- < 300
- 300 - 400
- 400 - 500
- 500 - 600
- 600 - 800
- > 800

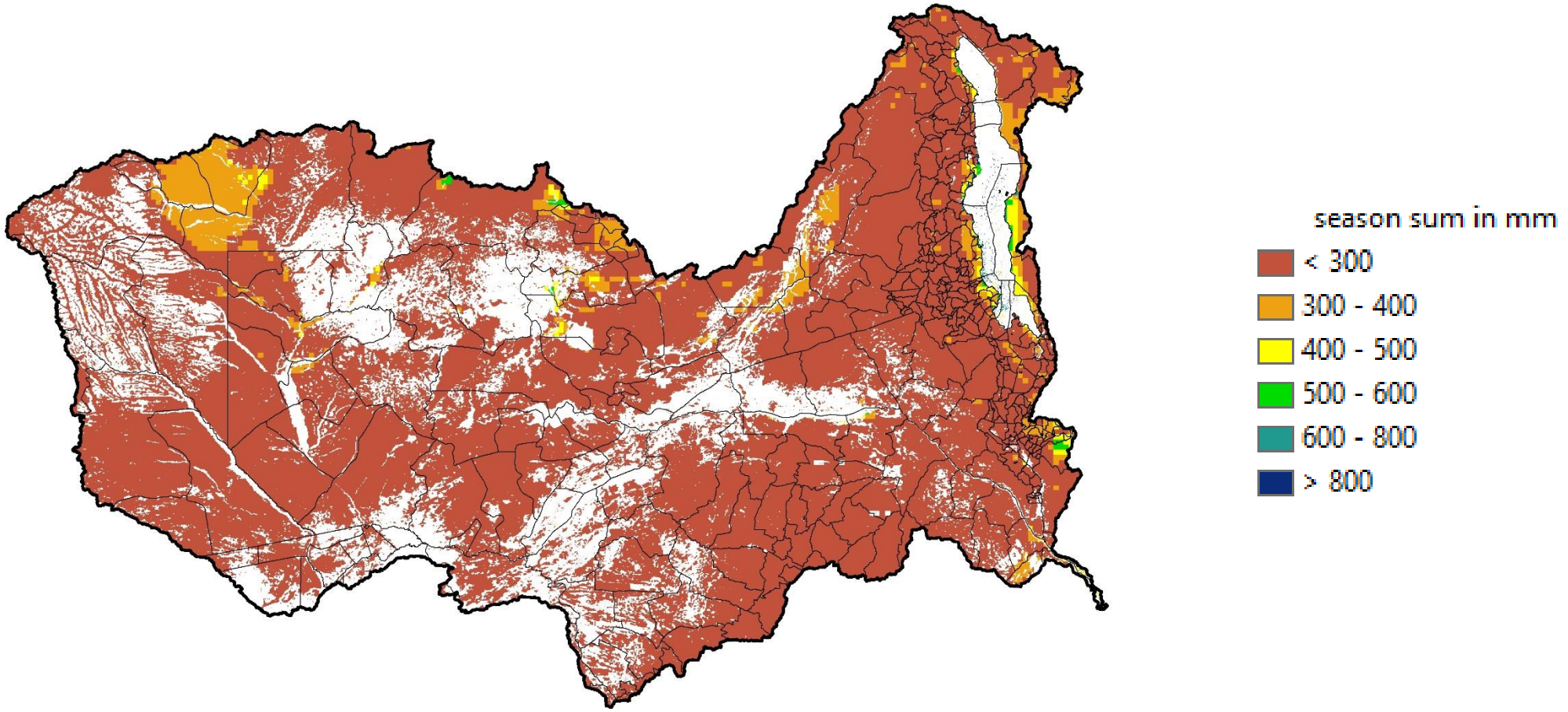
Dry season P (mm/year) (May–Oct)



Dry Season P-ET (mm/season)(May –Oct)



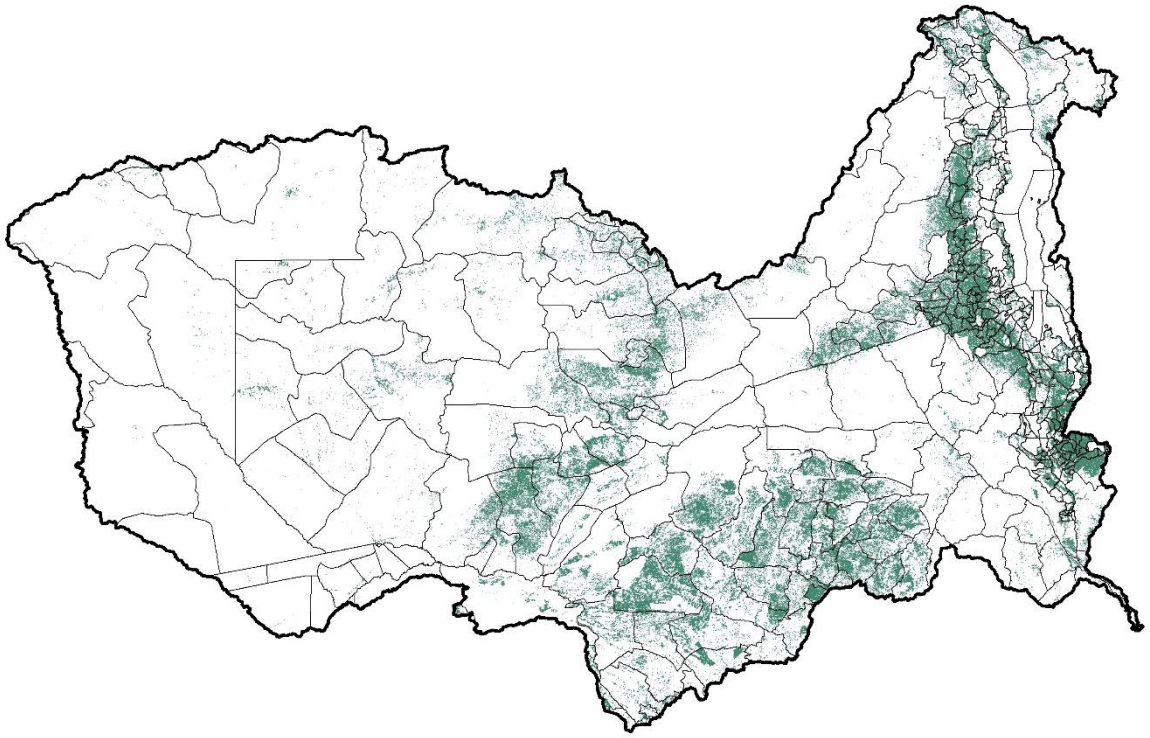
Utilizable Groundwater

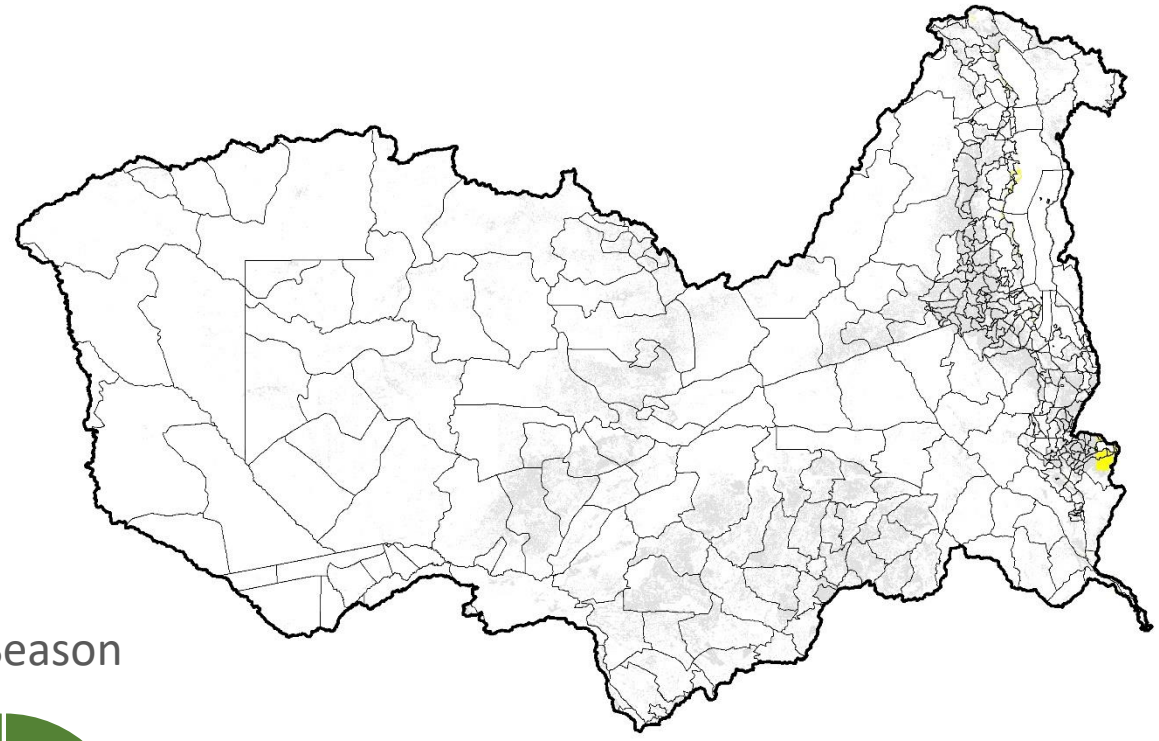


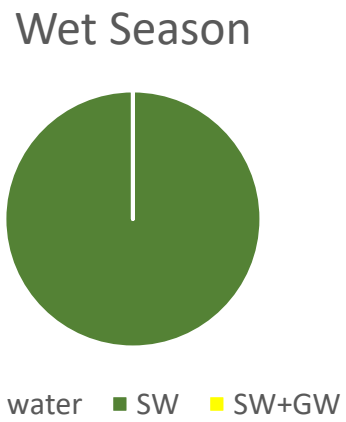
Utilizable groundwater = safe yield – current gw use

Sustainable Groundwater Use – 400 mm

Crop Water Requirement of 400 mm (plus 52% of losses added)

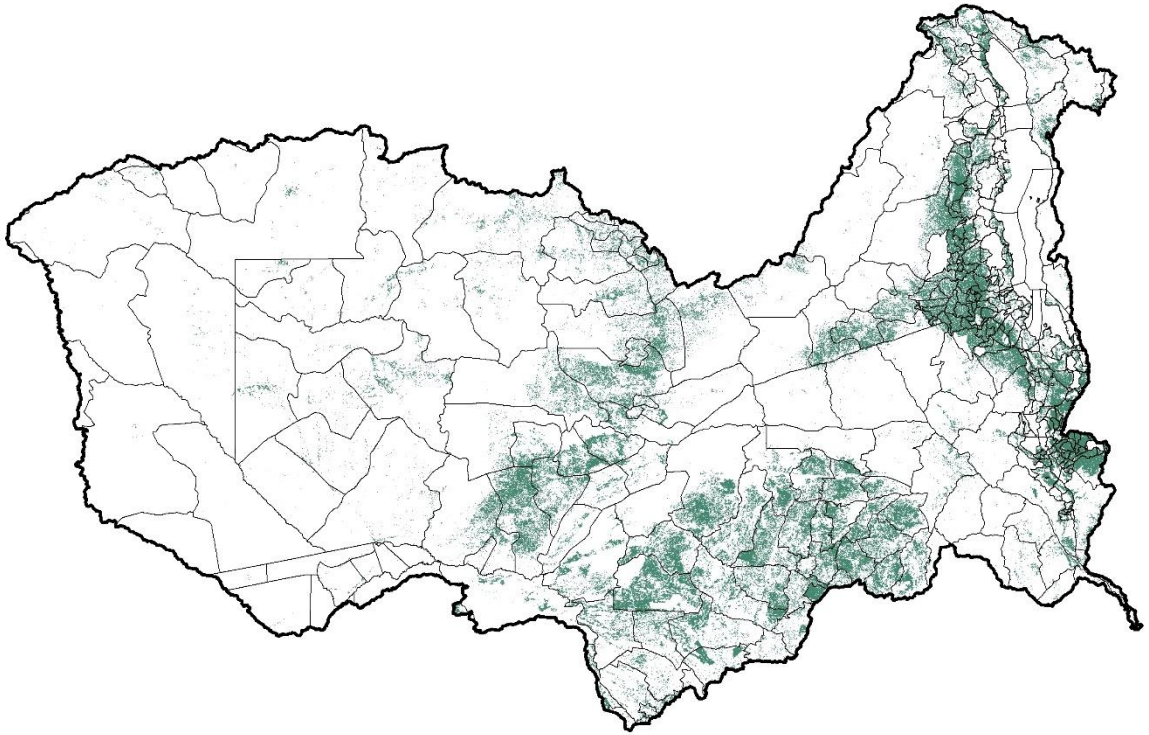


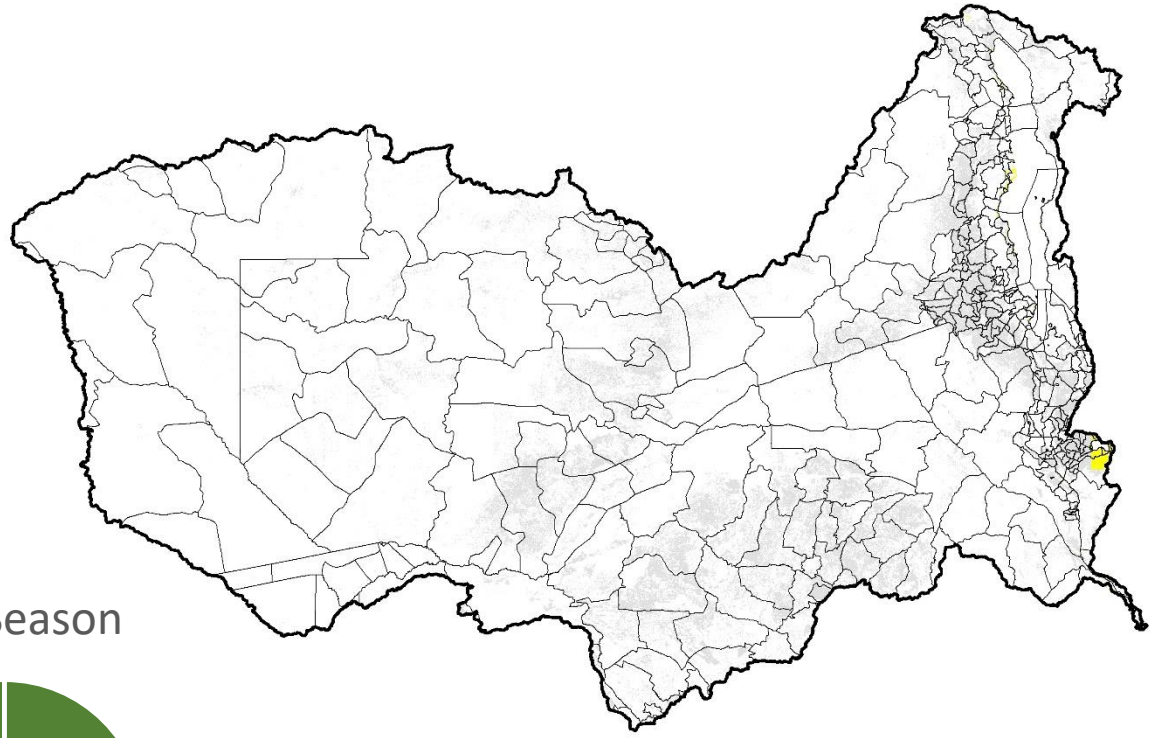


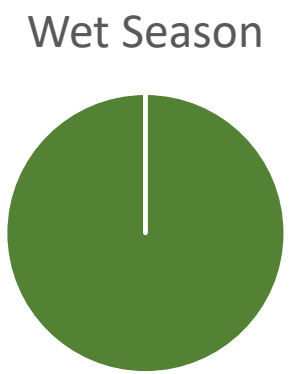


Sustainable Groundwater Use – 500 mm

Crop Water Requirement of 500 mm (plus 52% of losses added)

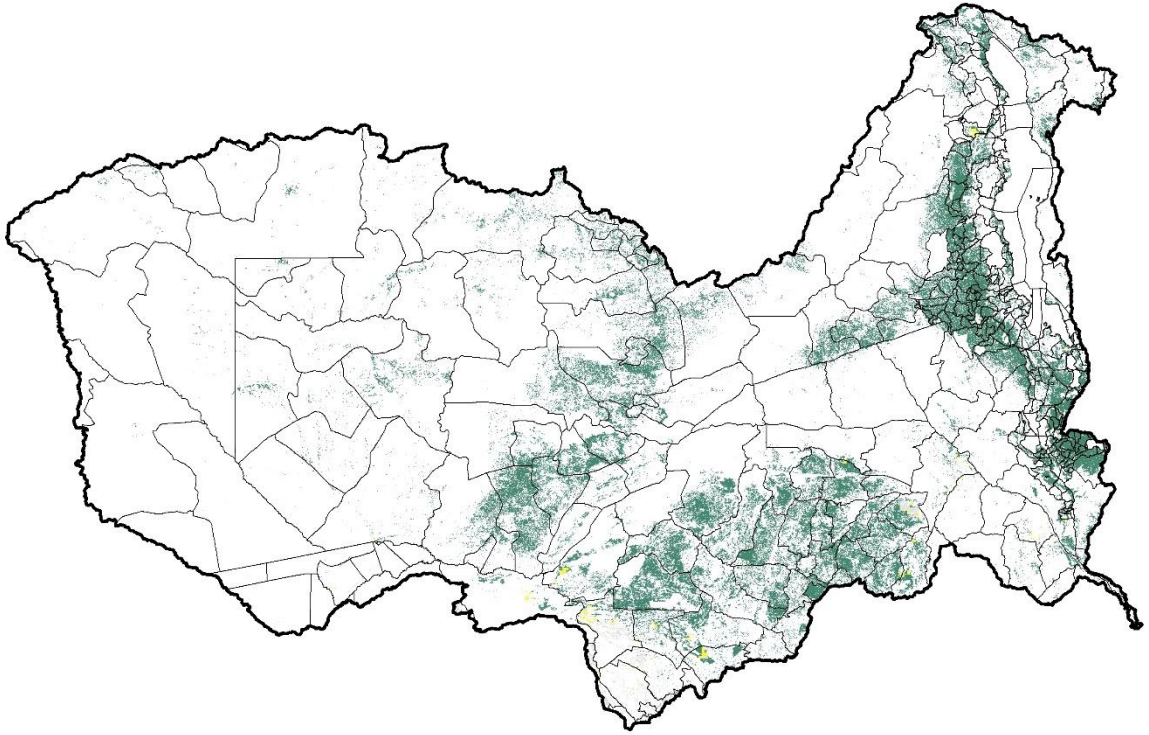


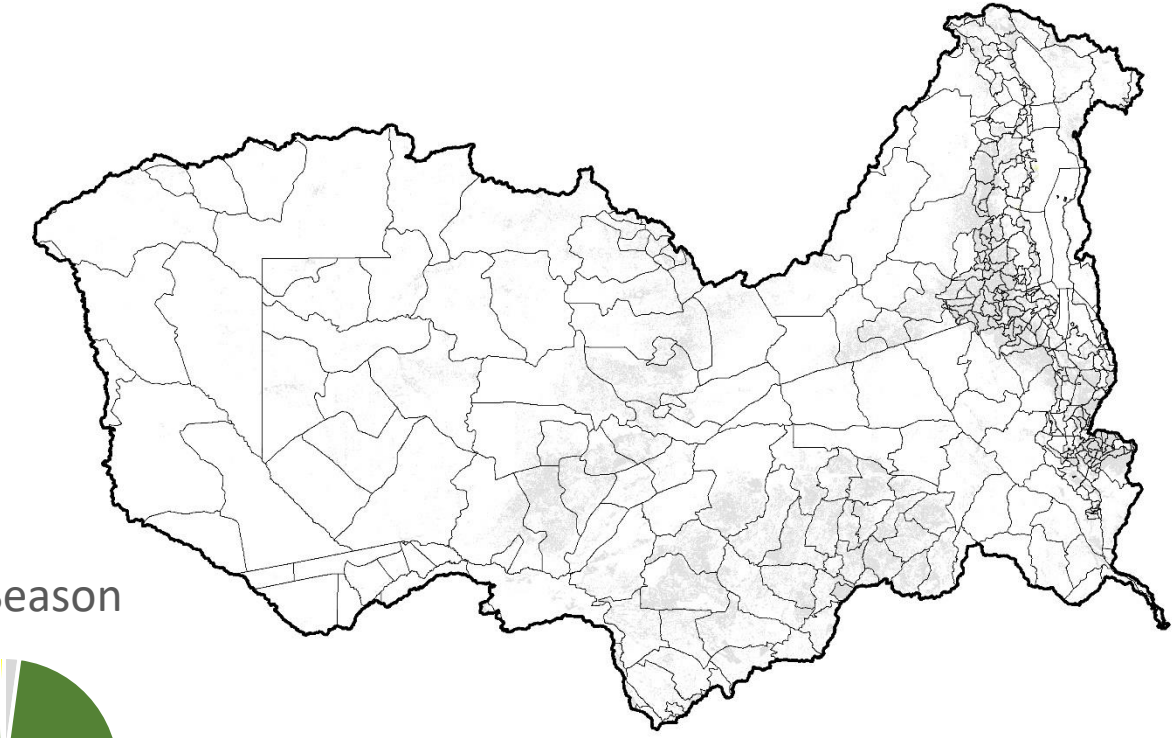


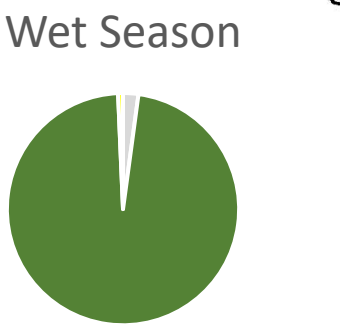


Sustainable Groundwater Limits – 600 mm

Crop Water Requirement of 600 mm (plus 52% of losses added)

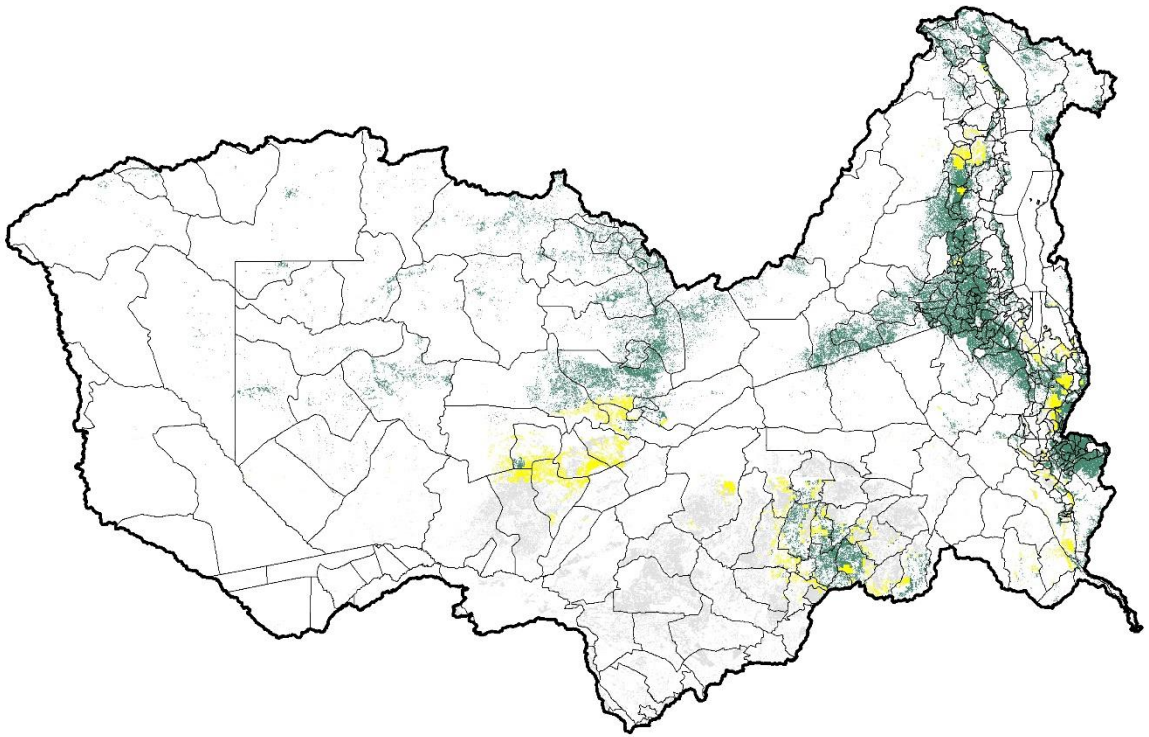


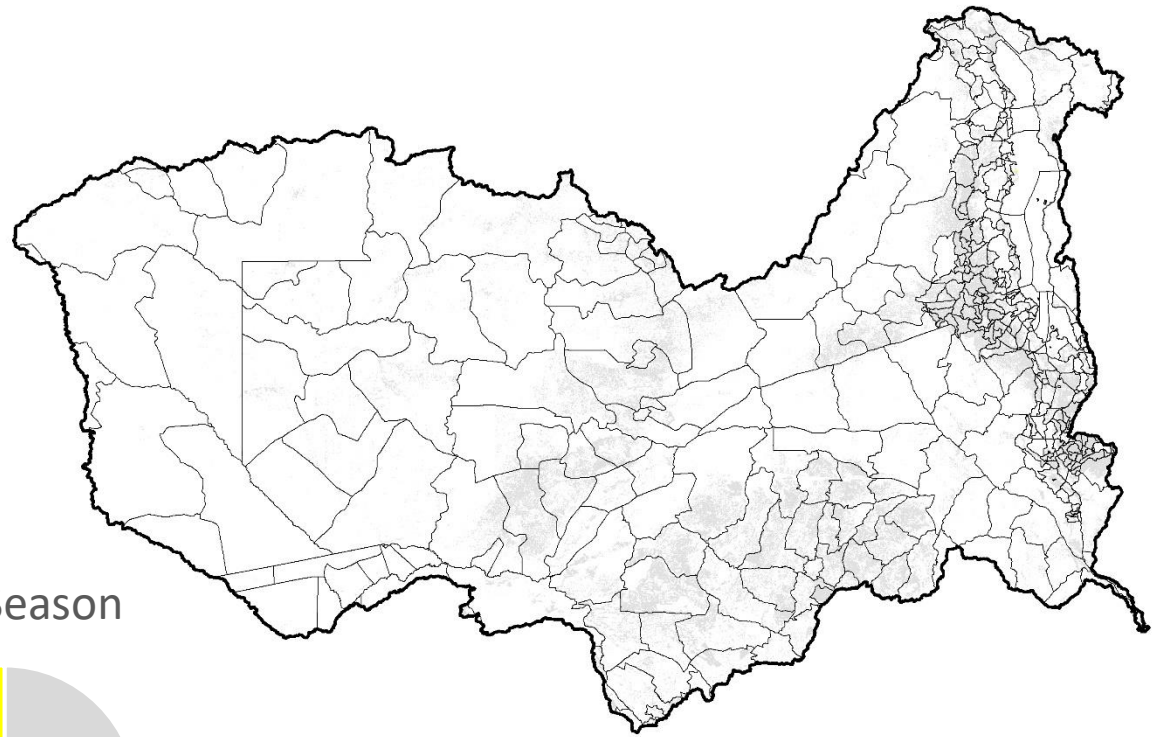




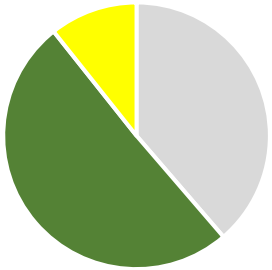
Sustainable Groundwater Limits – 800 mm

Crop Water Requirement of 800 mm (plus 52% of losses added)



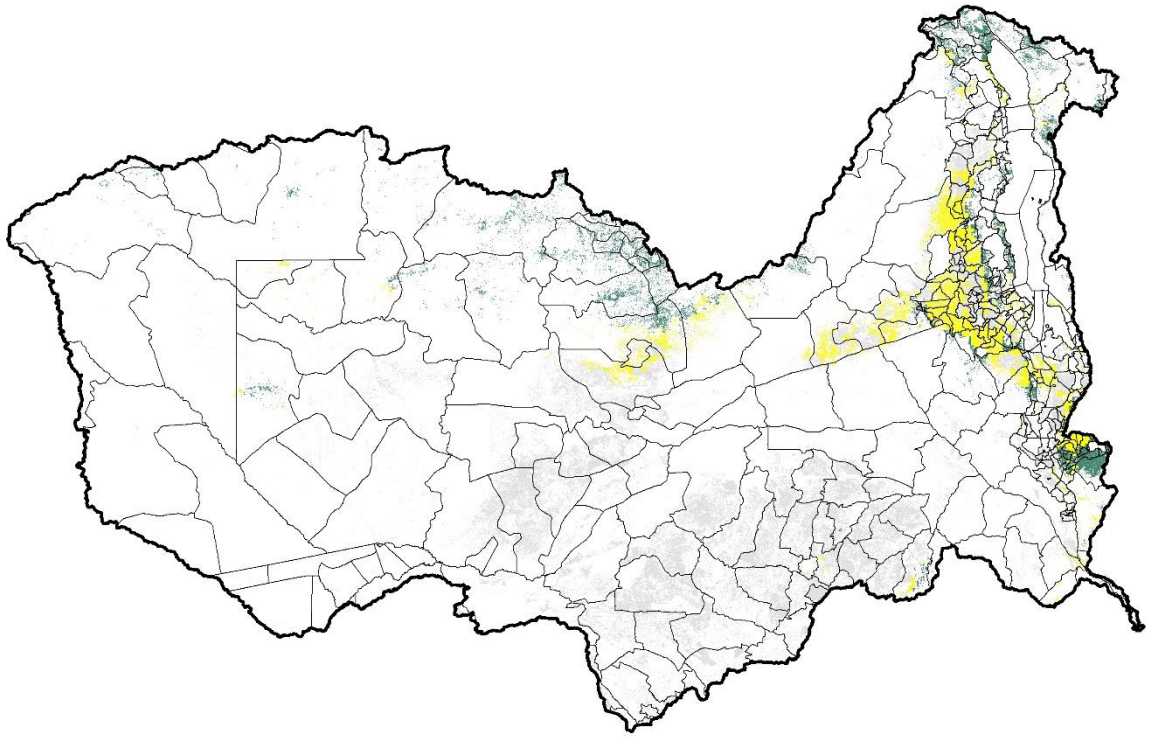


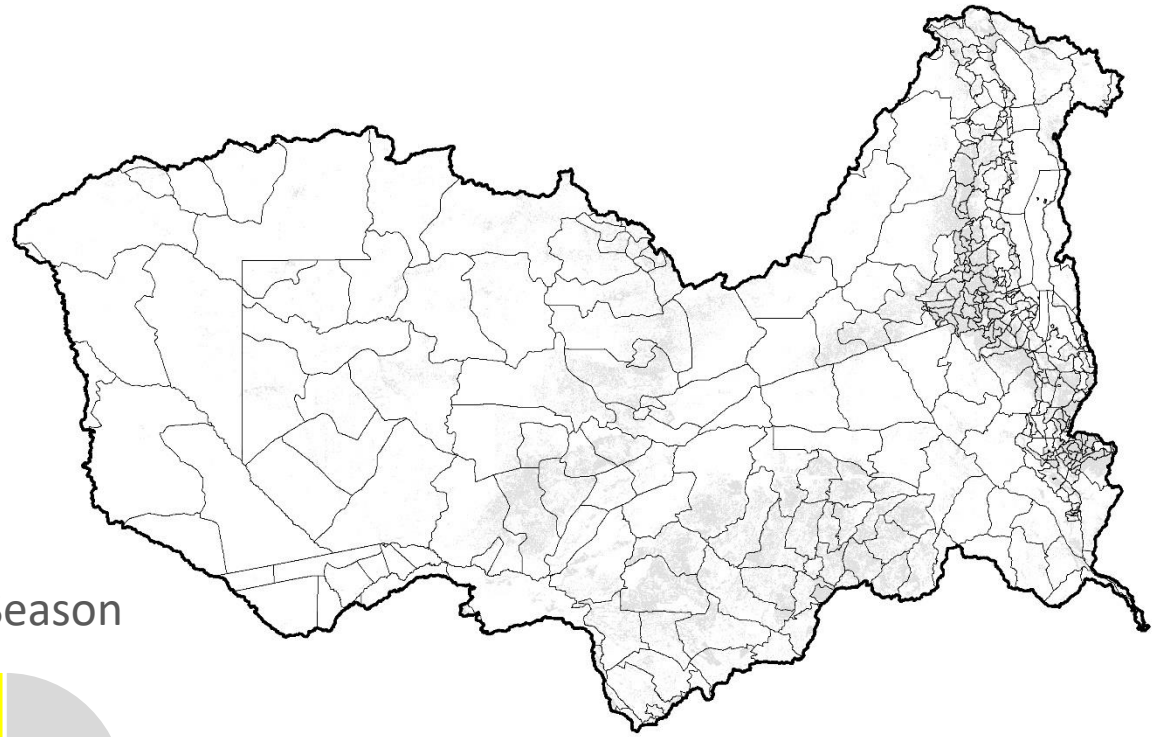
Wet Season



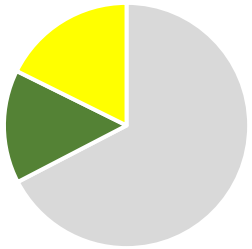
Sustainable Groundwater Limits – 1000 mm

Crop Water Requirement of 1000 mm (plus 52% of losses added)



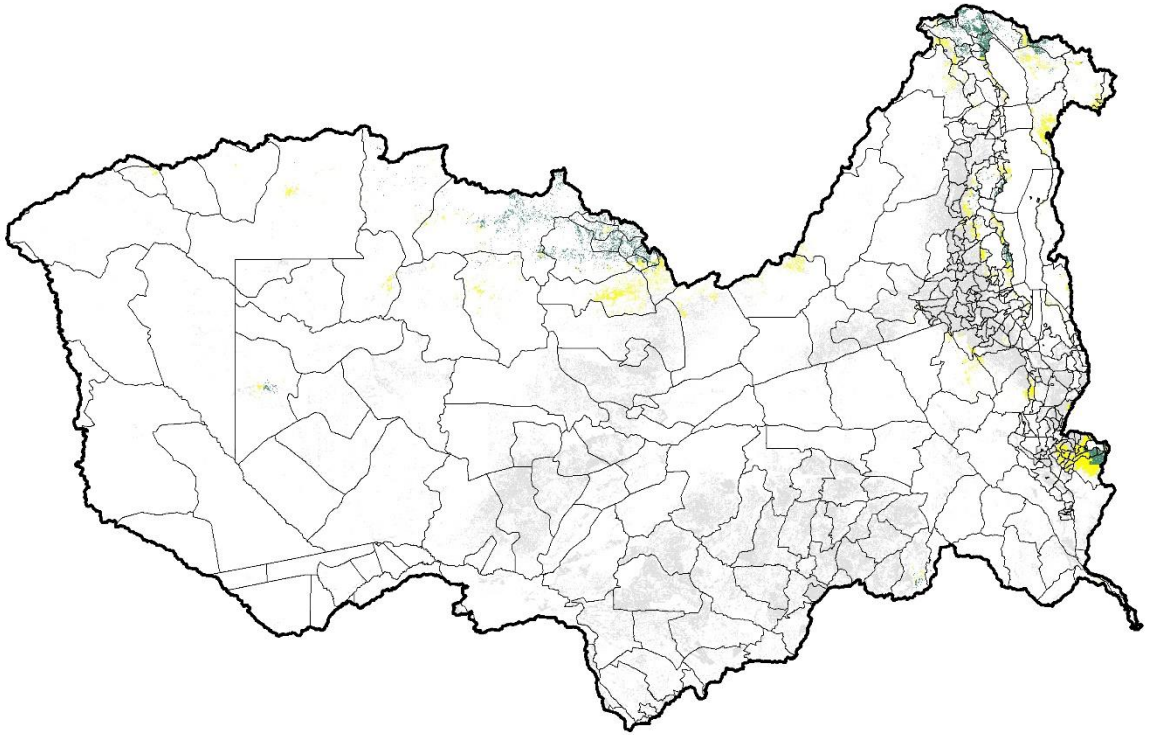


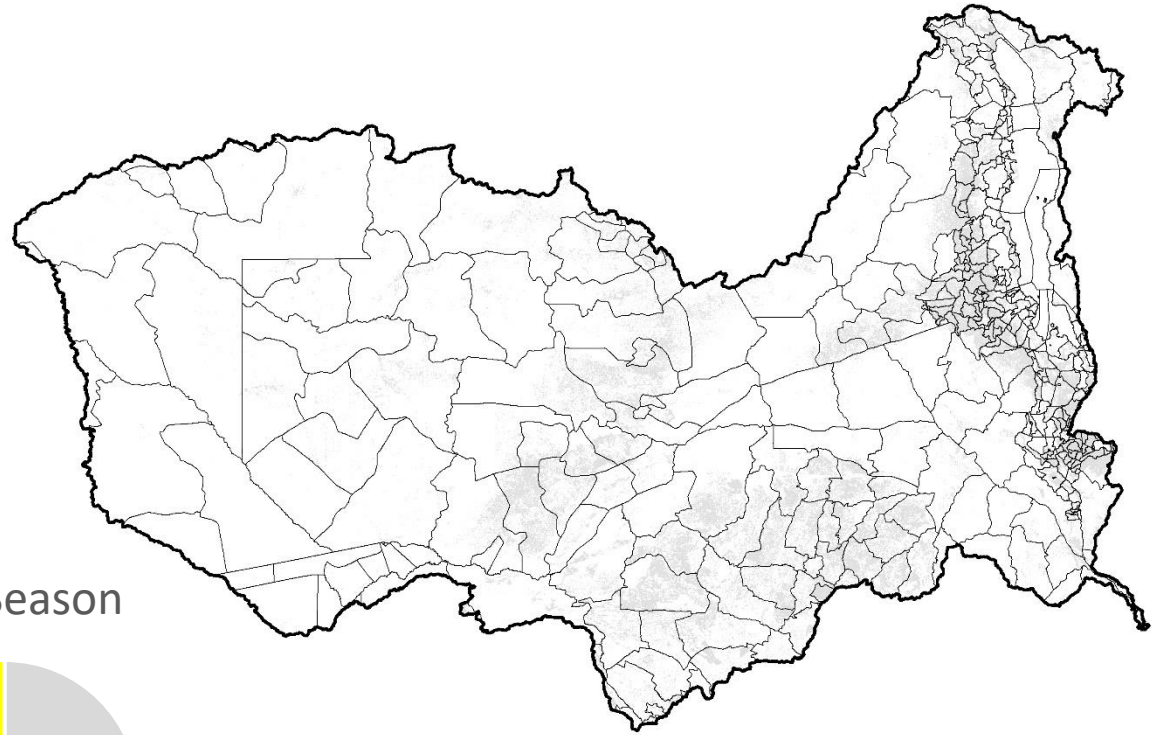
Wet Season



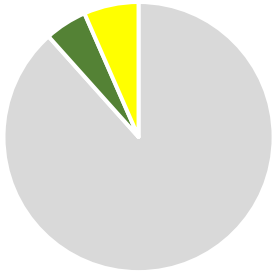
Sustainable Groundwater Limits – 1200 mm

Crop Water Requirement of 1200 mm (plus 52% of losses added)



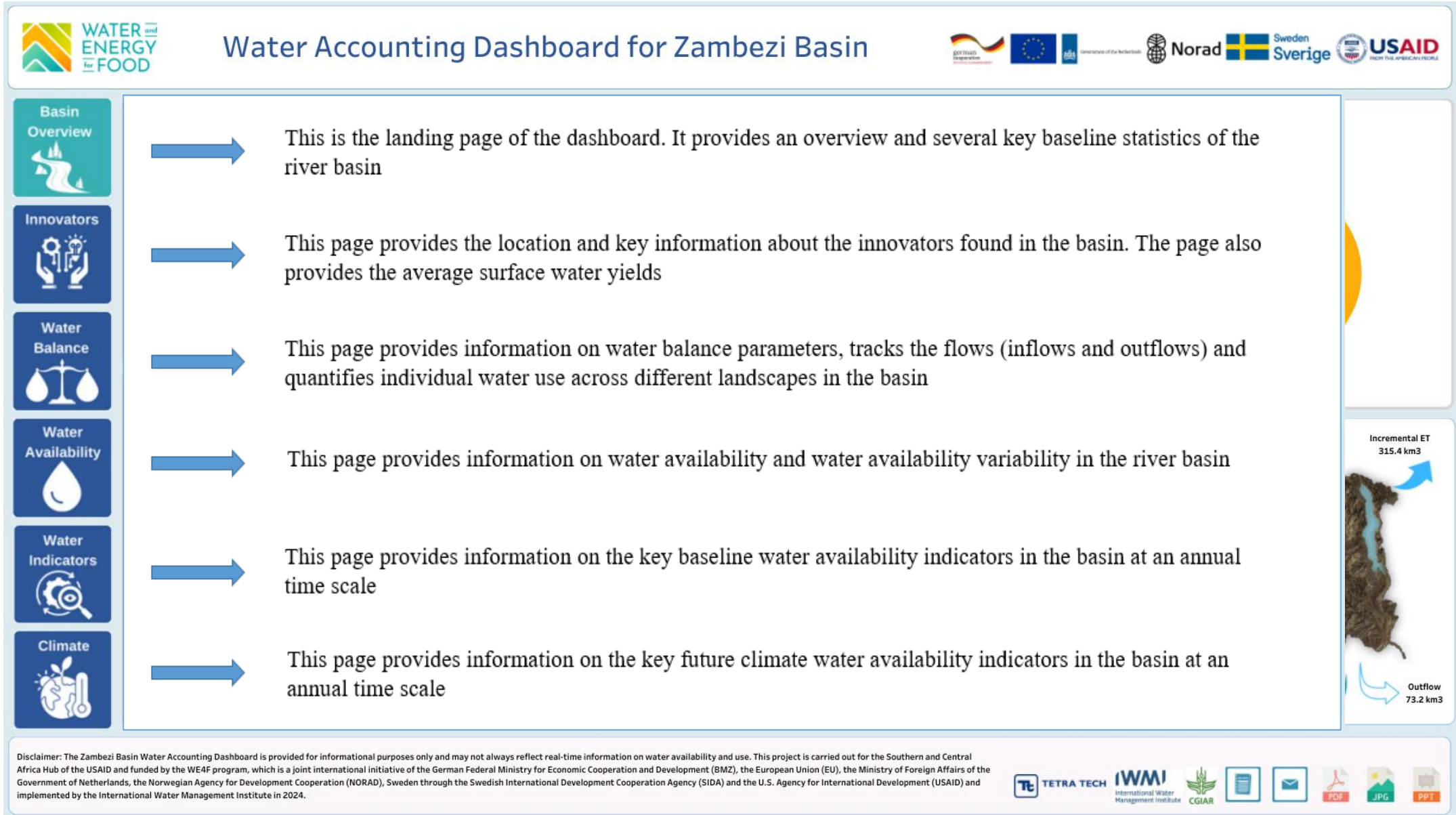


Wet Season



Zambezi Basin WA Dashboard

Dashboard Overview



Basin Overview

Water Accounting Dashboard for Zambezi Basin

Basin Overview | Innovators | Water Balance | Water Availability | Water Indicators | Climate

Overview:

The Zambezi is the fourth longest river in Africa and is the largest in Southern Africa with a total drainage area of approximately 1.4 million square kilometers. The river plays a central role in the economies of eight riparian countries: Angola, Botswana, Malawi, Mozambique, Namibia, Tanzania, Zambia, and Zimbabwe. The basin waters meet the basic needs of approximately 30 million people and sustains a rich and diverse natural environment. The key economic activities in the basin are agriculture, fisheries, mining, tourism, and manufacturing. Industry is dependent mostly on hydroelectric power, which is the main source of energy.

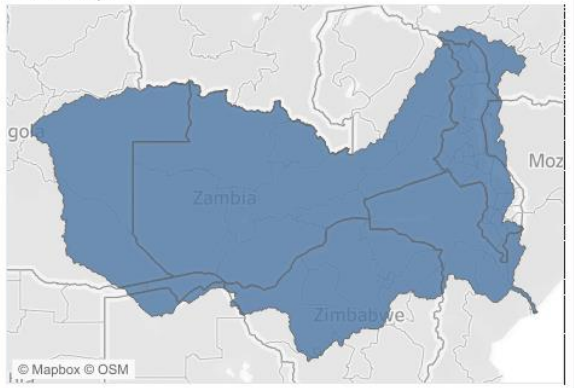
Insights: **Select Country:** All

Basin Area in Country (km2)	Basin Population	Enviro Water Stress (%) *	Per Capita Water Availability (m3) *	Water Availability (km3) *
1,380,823	58,348,678	50	10,600	89

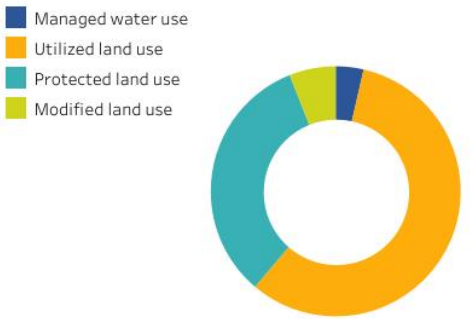
* zero indicates an insignificant value

This dashboard showcases inisghts generated from the Water Accounting Plus (WA+) framework. The WA+ framework was developed to use open-access remote sensing based data for water accounting at the basin level. The framework combines the Remote Sensing based data with other available global data sets and ground measurements to produce standardized WA+ sheets supported by graphs, maps, and tables.

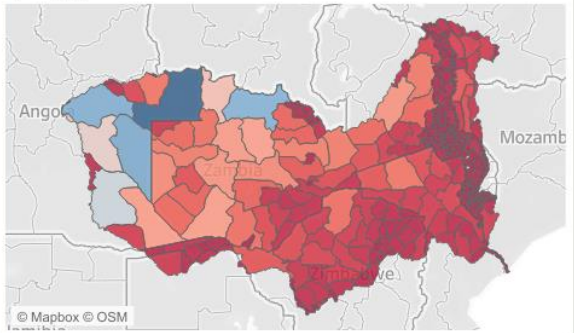
Basin Map:



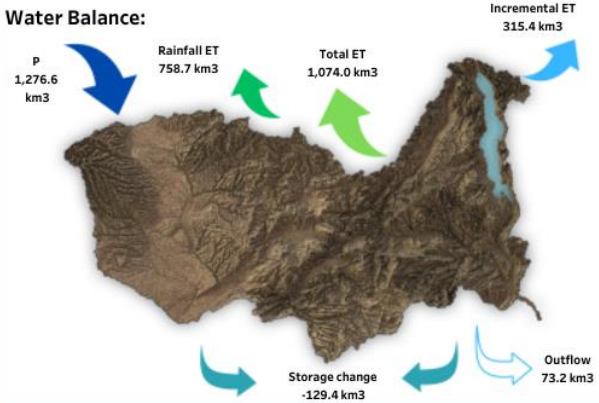
Land Usage:



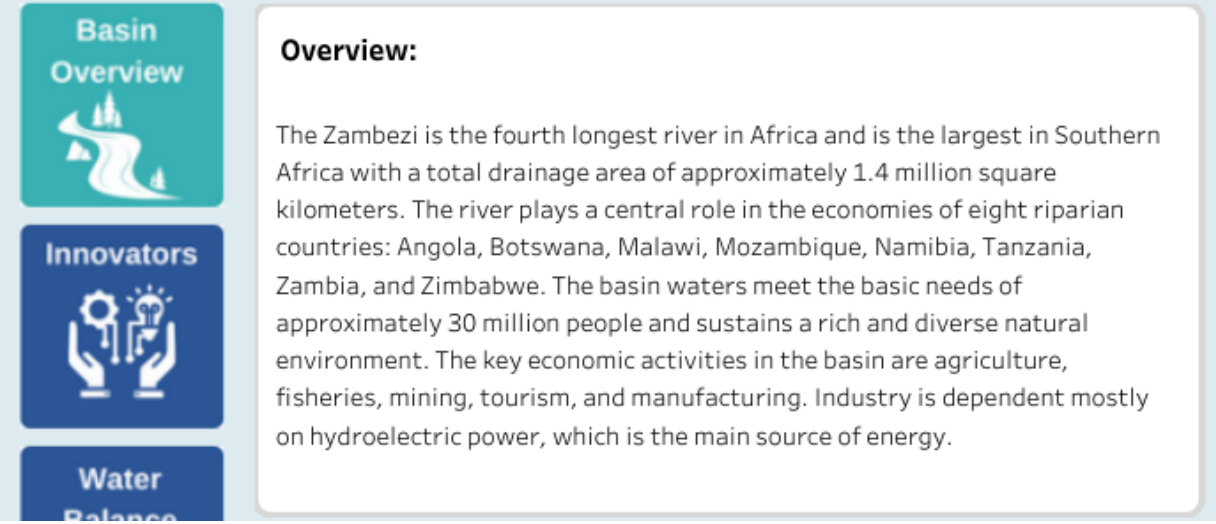
Annual Rainfall Distribution (km3/yr):



Water Balance:

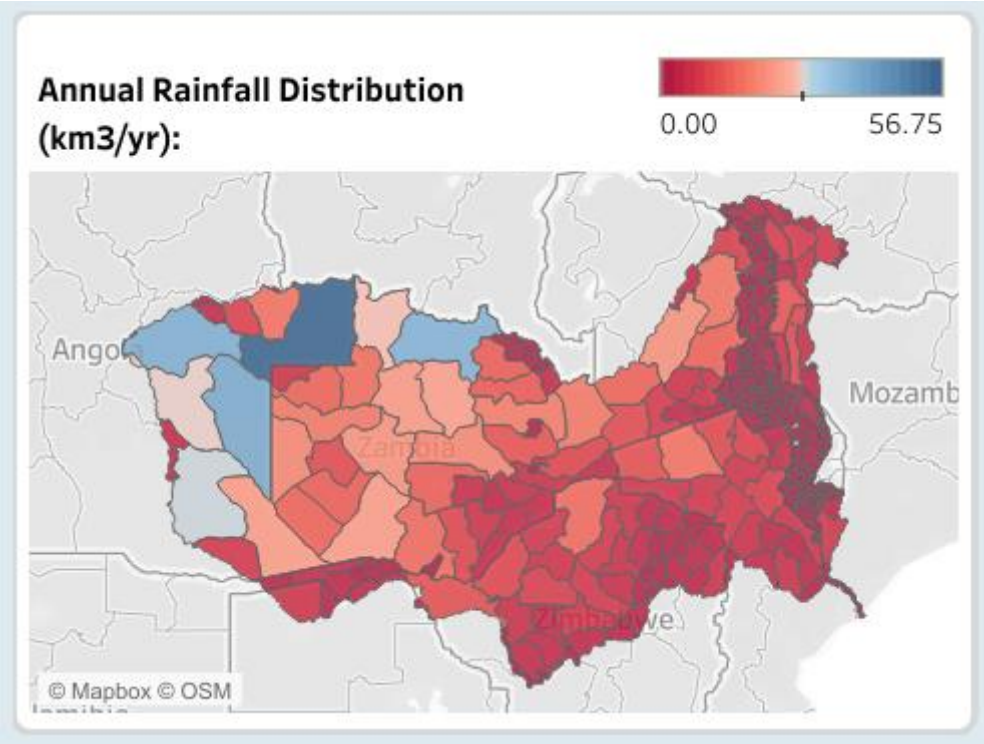


Basin Overview – Description



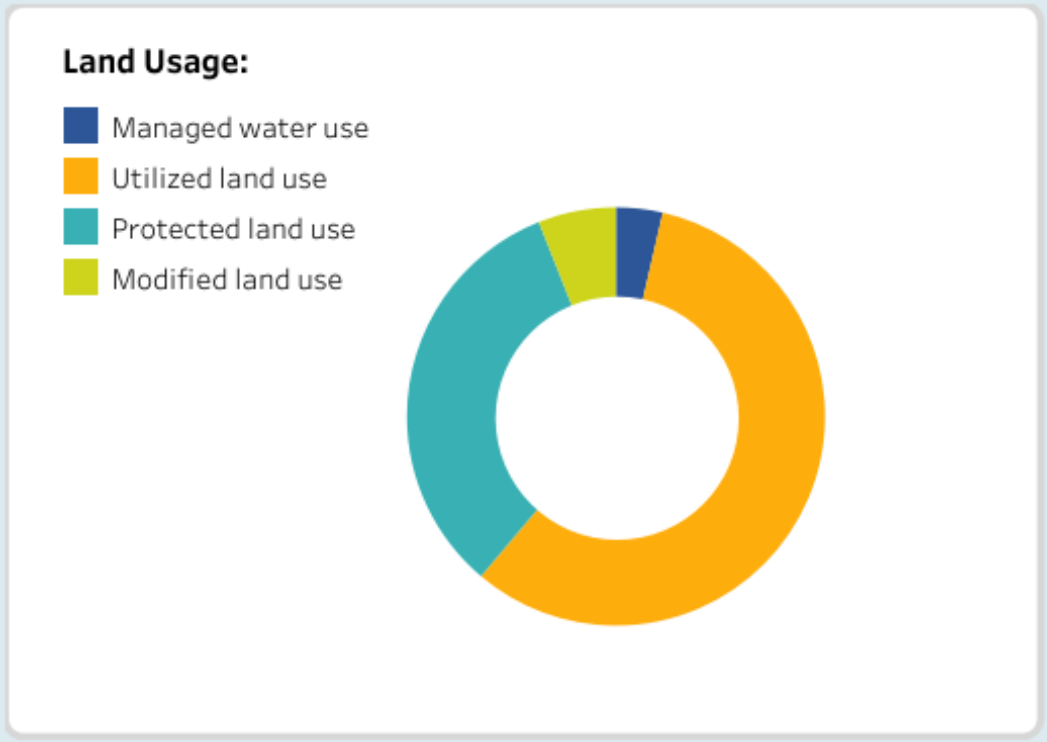
- Provides a brief synopsis of the dashboard.
- Brief account of the basin hydrology
- Highlights important hydrologic challenges in the basin.

Basin Overview – Annual Rainfall Distribution



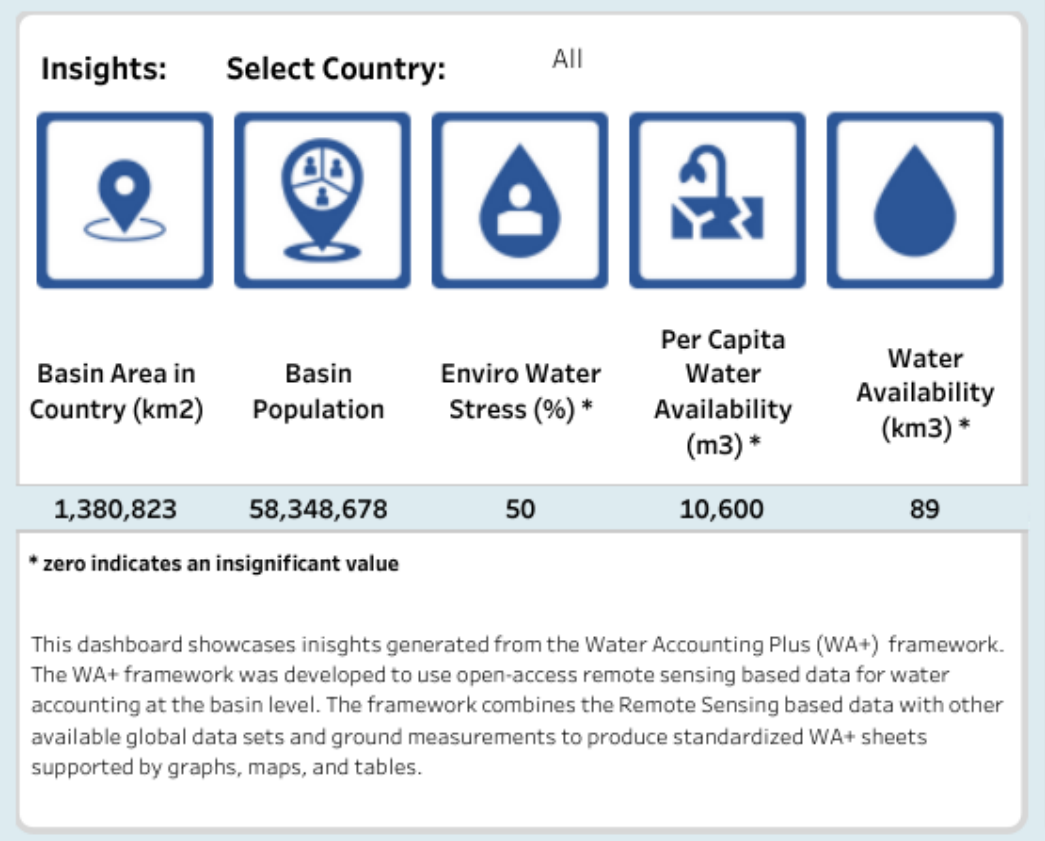
- Provides a choropleth map of the average annual rainfall distribution
- Map is interactive.
- Millimetres per year.

Basin Overview – Land usage



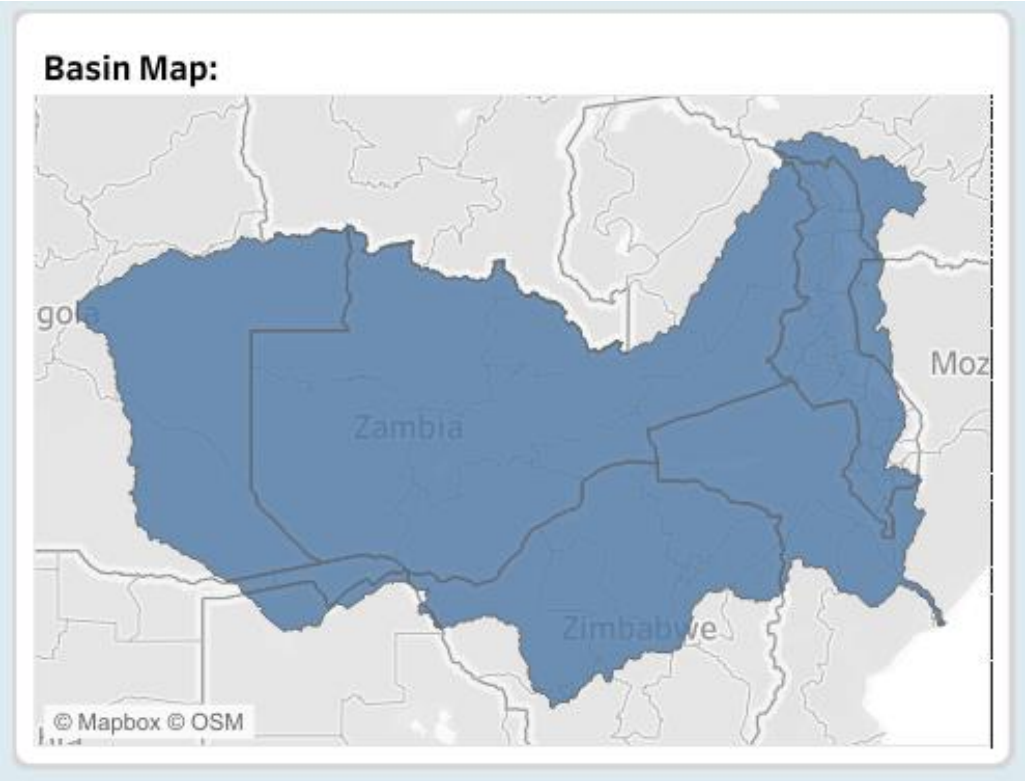
- Provides the distribution of land use classes across the basin. These are provided in a pie chart. The different
- The Utilized land represents natural landscapes that are utilized in their natural forms, without modifying or altering water and land resources.
- The Modified land represents area where land is modified for human use. For example, the natural landscapes are cleared/modified to grow crops under rainfed conditions. 4) Protected land use defines the area that is classified as protected such as national parks or other preserved areas
- The Managed water class represents areas that are managed for agriculture where water is highly managed, such as irrigation.

Basin Overview – Insights



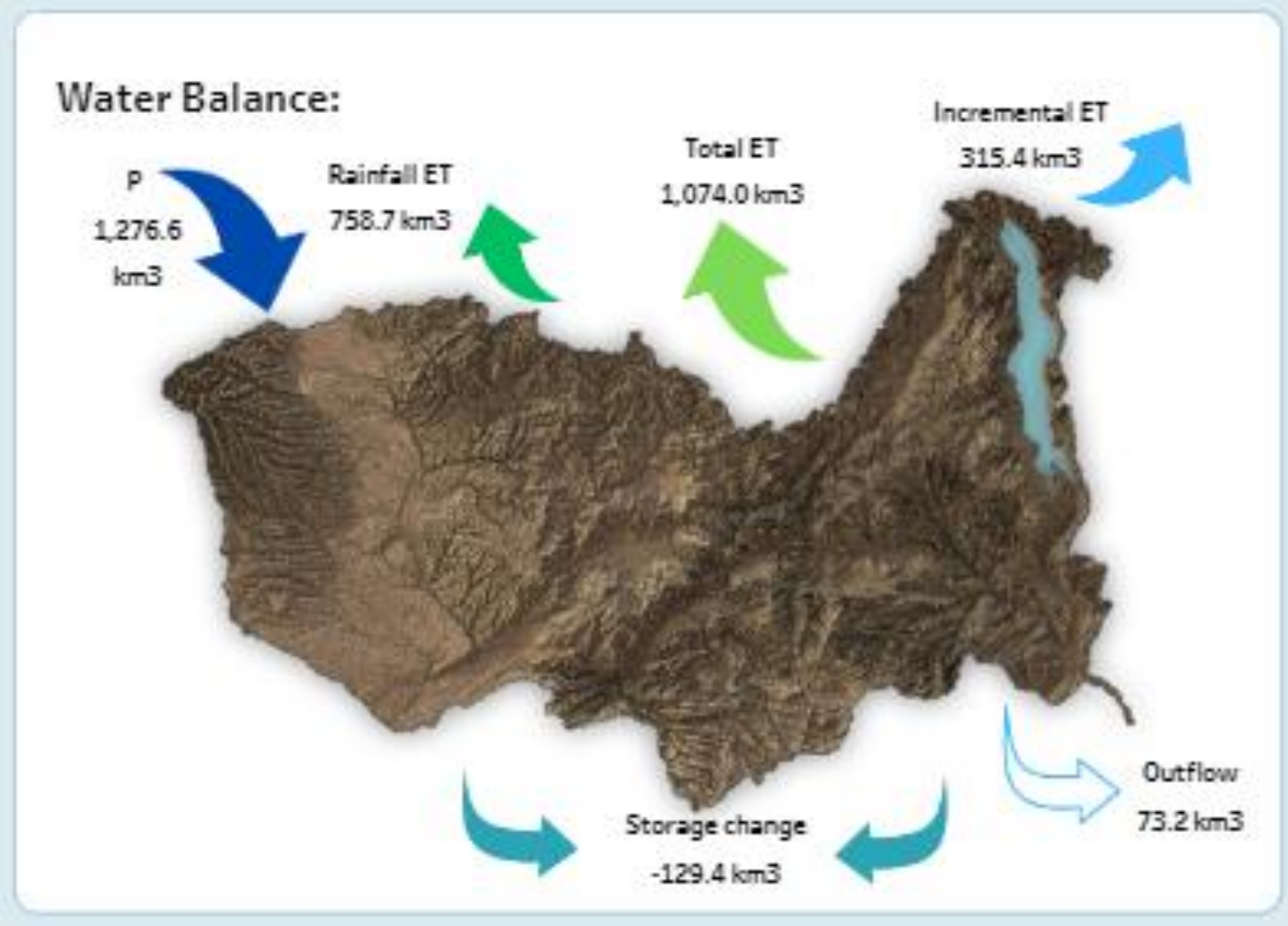
- Provides basic information on basin insights
- Provides basin area, population, per-capita water availability, average environmental water stress and water availability for future use.
- Interactive and provided for each country in the basin

Basin Overview – Basin Map



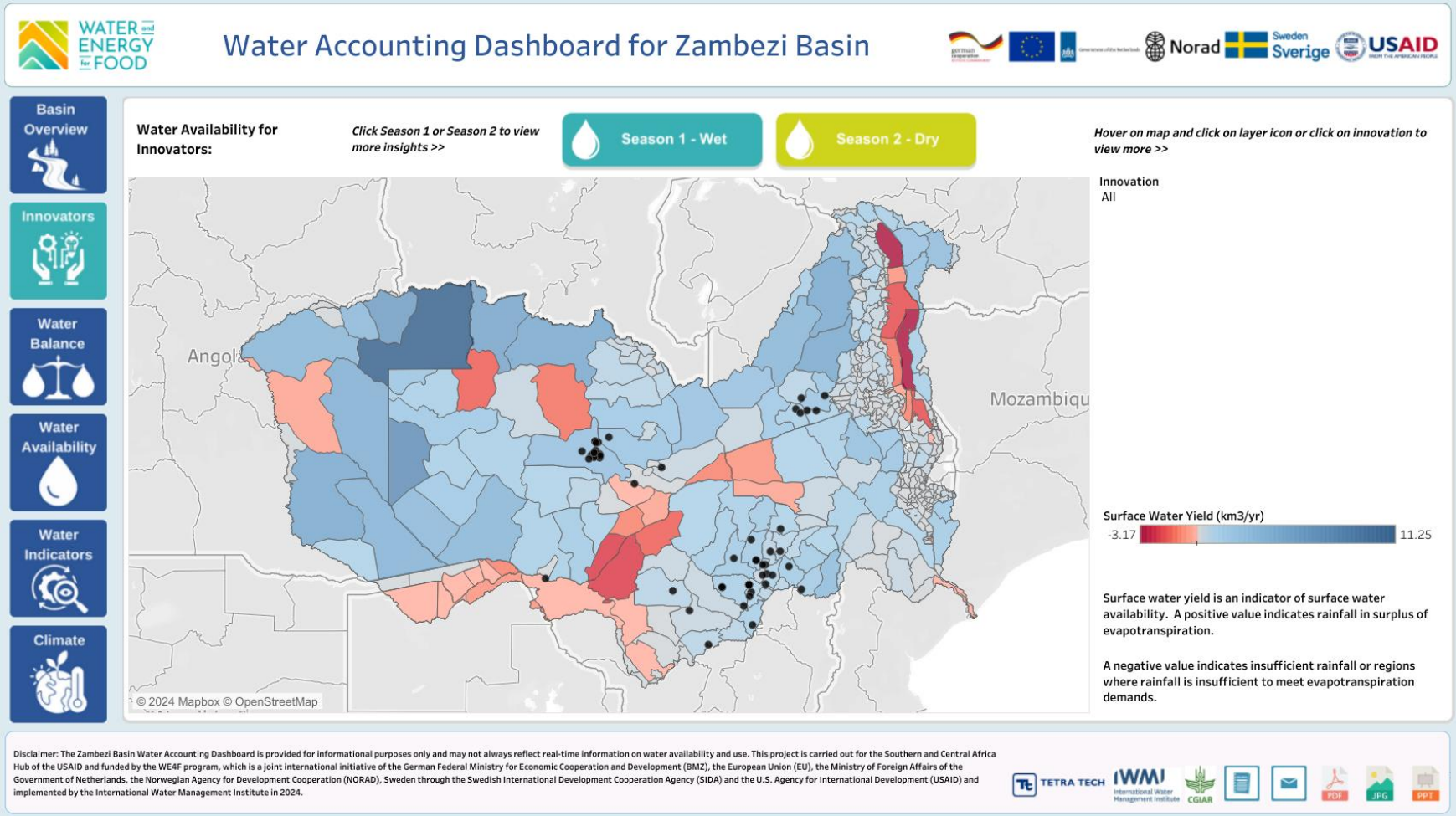
- Interactive map of the river basin
- Users can zoom in and out of the basin area overlaid on the world map using the + and – symbols
- The home icon on the map will reset the map to the full extent of the basin
- The triangle icon offers additional features for interacting with the map

Basin Overview – Water Balance



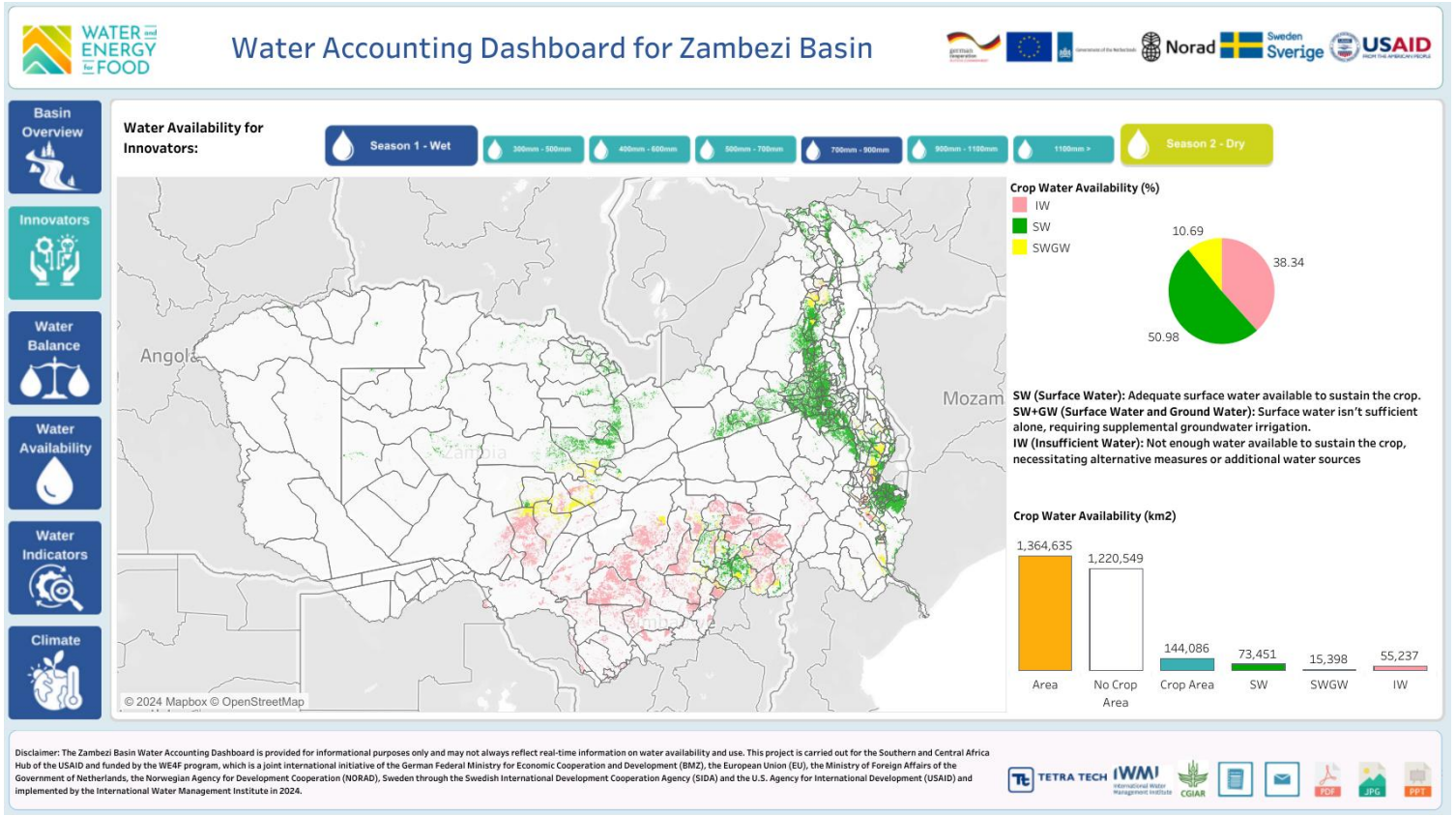
- Shows modeled estimates of key water balance terms
- P represents the total volumetric average annual precipitation received in the basin
- Total ET represents average total volumetric evapotranspiration
- Blue ET is the portion of total ET occurring from the blue water sources (surface water bodies, river, lakes or shallow groundwater aquifers)
- Rainfall ET or Green ET is the portion of total ET occurring from the green water sources (soil moisture replenished by the rainfall).
- Basin outflow is the volume of water that leaves the basin through the mouth of the river
- Storage change denote the changes in the basin storage due to either groundwater abstraction (+ve value) or groundwater recharge (-ve value).

Innovators Page



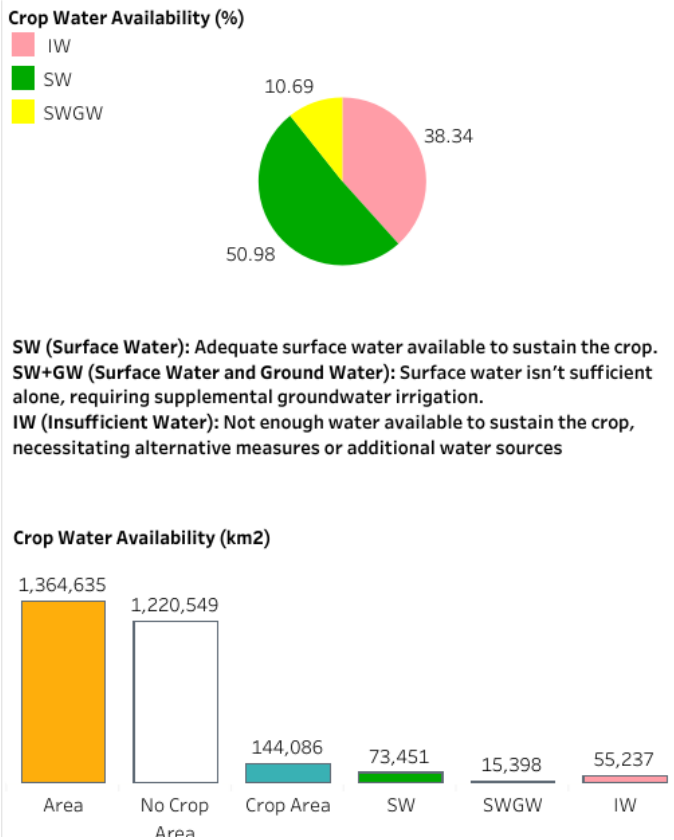
The innovators page provides information on the innovators found within the basin. The page provides interactive analysis layers. The page provides an interactive choropleth base map that gives the average annual surface water yield per district. The page provides the locations of different innovators located within the basin, and the innovations that are adopted.

Innovators with Water Availability for Crops



- Sustainability framework analysis results available for the wet and dry seasons
- Sustainability framework results available for 400mm, 500mm, 600mm, 800mm, 1000mm and 1200mm

Innovators

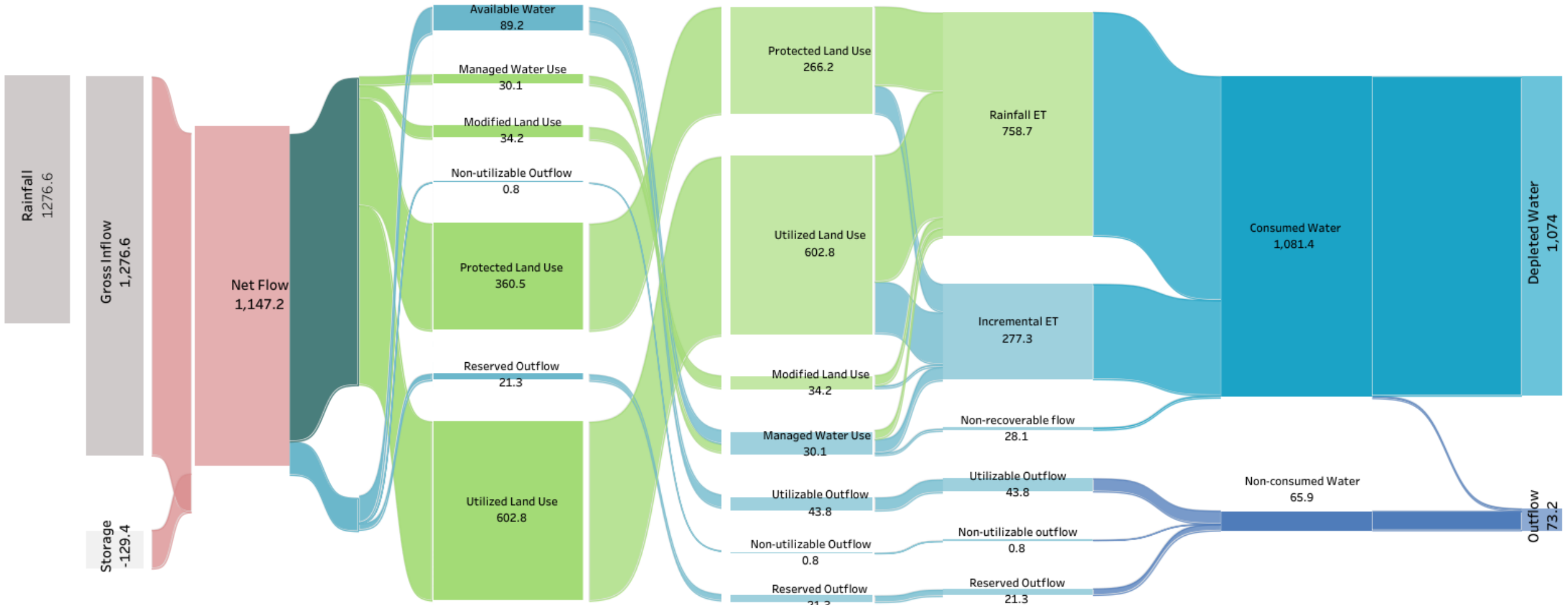


- The tab provides a pie chart that gives the percentages of IW, SW and SWGW

- The tab also provides a bar chart showing the crop water availability as well as the total area and no crop area

Water Balance Chart

Water Balance(km3/yr):



Water Balance

- Shows inflows on the left, and outflows on the right

- Depletion accounting is used to estimate how much of water is consumed over different landscapes.

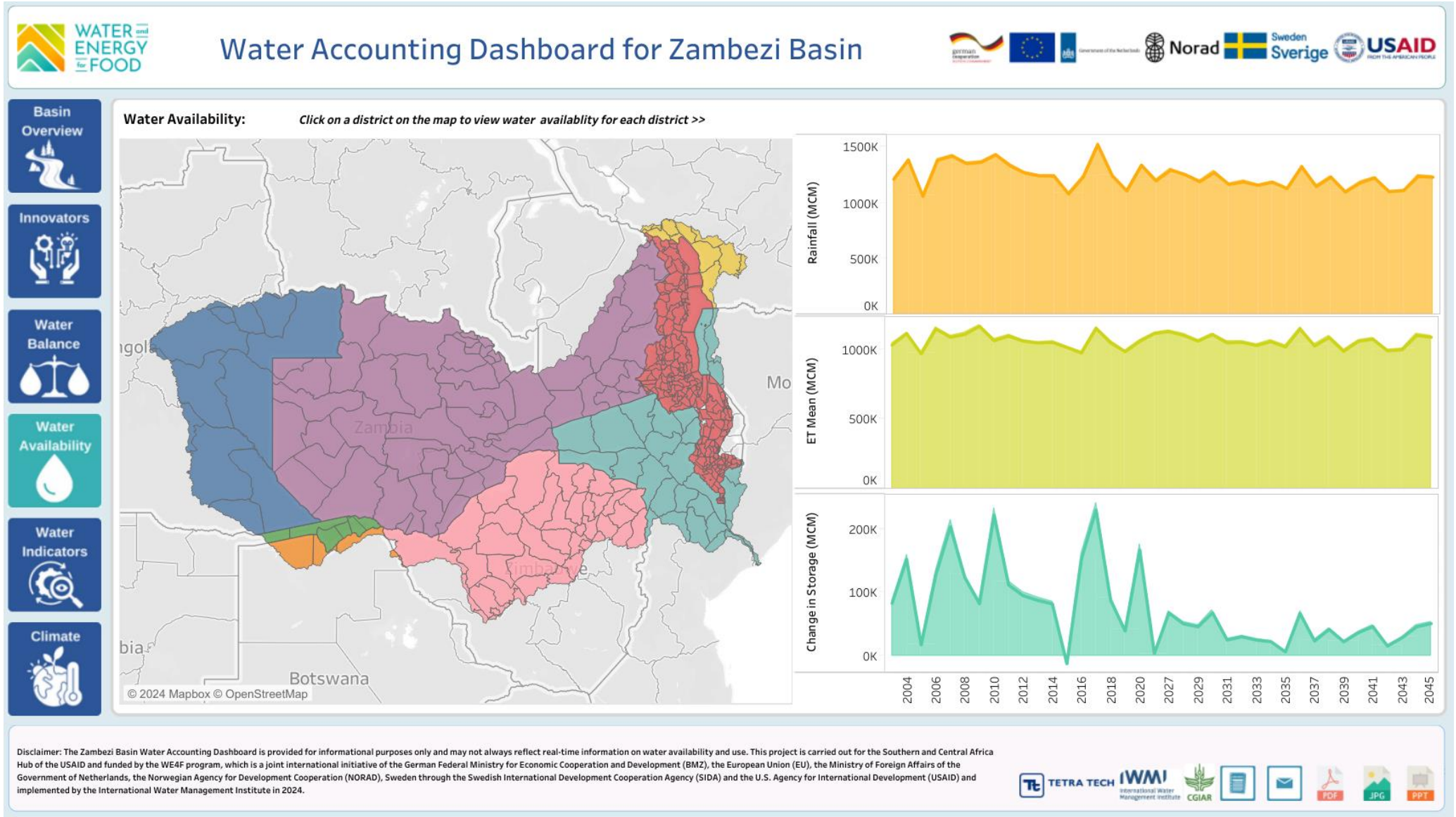
- Summarized under four broad categories of land cover/land use –
  - Protected- conservation areas with minimal changes in land and/or water management;
  - Utilized- are areas with limited human influence and can include forest, natural pastures, savannahs and deserts;
  - Modified- areas that are significantly modified by human activities usually for rainfed agriculture; and
  - Managed water use- are land use classes that are significantly modified for agriculture and include water purposefully withdrawn from the surface or groundwater sources for use.

- The flow accounting derives a number of parameters such as exploitable water, available water, managed water use, utilizable flows, non-utilizable outflows, reserved outflows, and non-consumed water.

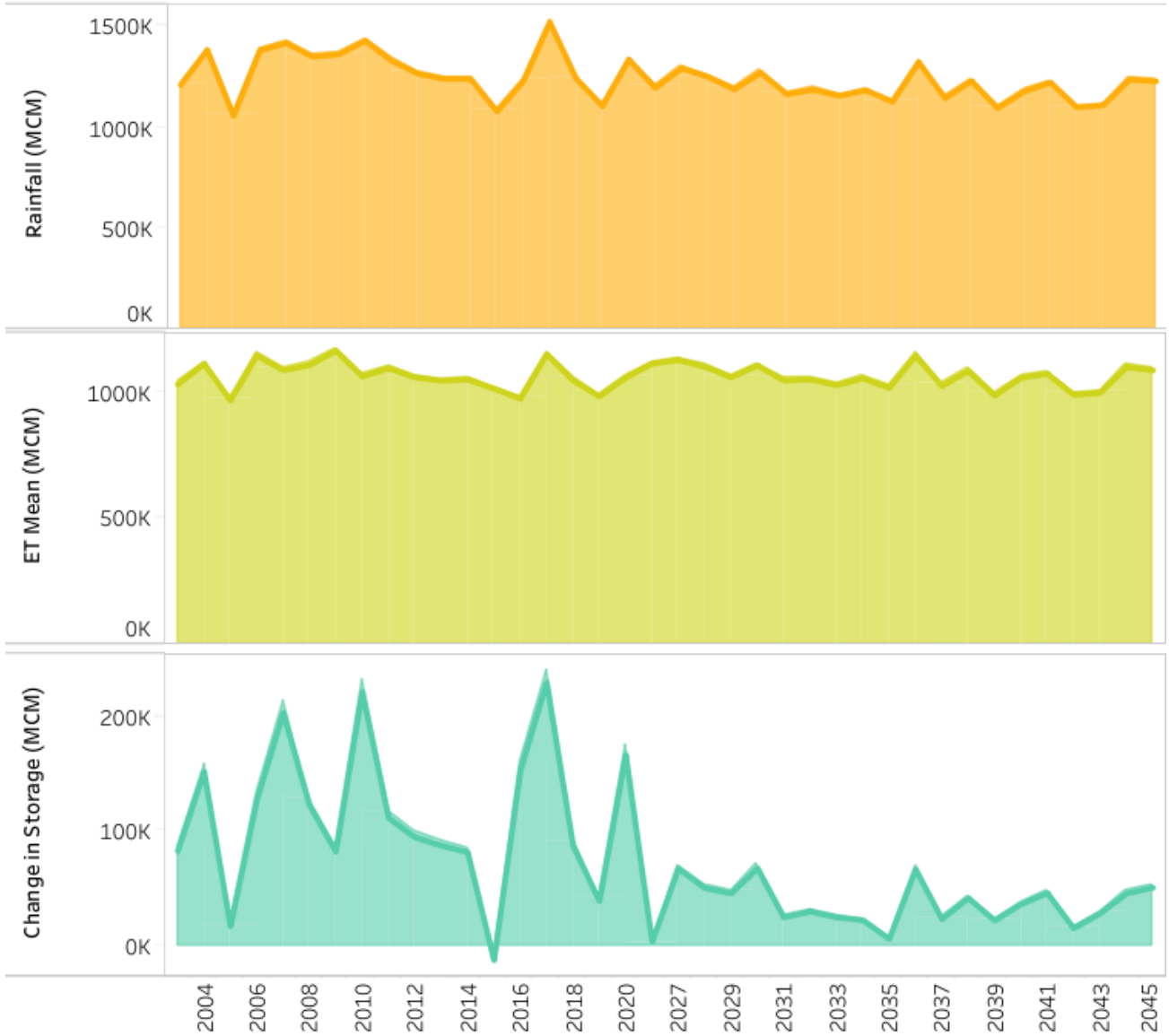
Water Balance – Indicators

No	Flux/Indicators	Description	Equation
1	*P* advection	Precipitation received in the basin, aggregated over the hydrologic year	$\sum_{i=1}^{12} P$
2	Basin inflow (interbasin transfer)	Surface water or groundwater diverted into the basin	Q_{in}^{sw} and Q_{in}^{gw} (Measured estimates)
3	Gross Inflow, *GI*	Total inflow from all sources	$P + Q_{in}^{sw} + Q_{in}^{gw}$
4	Change in the soil moisture, ΔSM	See equation 2.	See equation 2.
5	Net Inflow, *NI*	The gross inflow plus the change in soil moisture	$GI \pm \Delta SM$
6	ET rainfall, ET_{rain}	ETa that occurs from effective precipitation and canopy interception, summarized for all land cover classes (1 to n classes).	$\sum_{i=1}^{n} ET_{rain}$
7	ET incremental, ET_{incr}	ETa that occurs from other sources except effective precipitation and interception. Includes ET from irrigation water, groundwater abstraction, open water sources, summarized for all land cover classes (1 to n classes).	$\sum_{i=1}^{n} ET_{incr}$
8	Landscape ET, ETa_{land}	ETa from natural landscapes (protected, utilized and modified land use classes); not due to water management.	$ET_{rain} + ET_{incr}$
9	Consumed water, C_{water}	Total ETa that occurs from all landscapes over all months	$\sum_{i=1}^{12} ET_a$
10	Utilized flow, $Uzed_{flow}$	ETa from managed water use (irrigated crops, managed reservoirs).	ET_{incr} from the managed water use class
11	Exploitable water, EX_{water}	The exploitable water is the amount of water that can potentially be used within the basin	$NI - ET_{landscape}$
12	Available water, *AW*	The water that is left after meeting ET and reserve flow requirements	$GI - ETa_{land} - Reserve\ Flows$
13	Utilizable outflow, $Uzble_{flow}$	The water that can be reallocated for further uses after accounting for reserved flows and utilized flows.	$EX_{water} - ER_{flow} - Uzed_{flow}$
14	Qsw outlet	The river outflow at the outlet of the basin	Q_{outlet}^{sw}
15	Basin outflow (interbasin transfer)	Surface water or groundwater diverted to areas outside the basin	Q_{out}^{sw} and Q_{out}^{gw}
16	Non-consumed water, NC_{water}	Total outflow	$Q_{outlet}^{sw} + Q_{out}^{sw} + Q_{out}^{gw}$

Water Availability

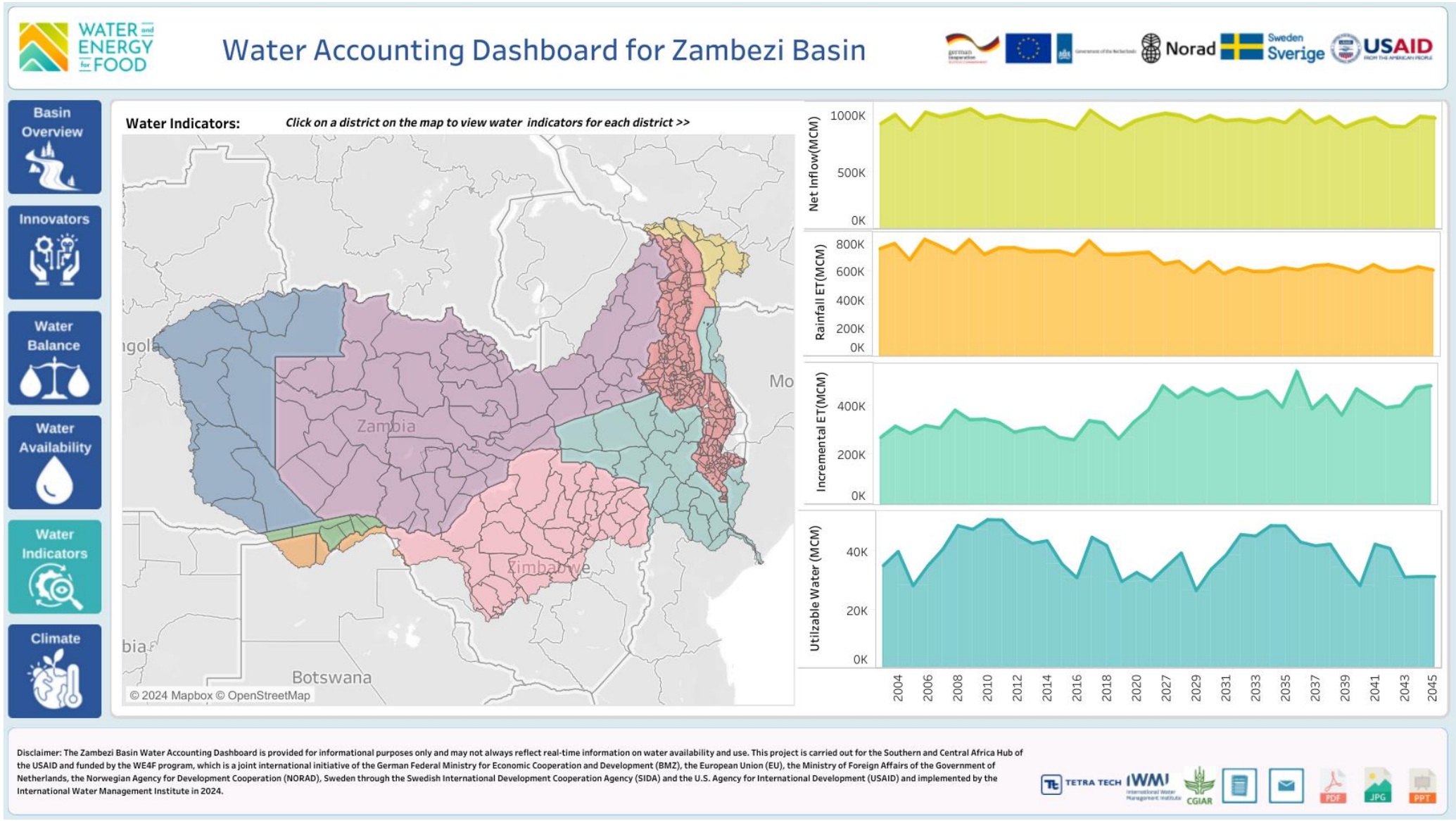


Water Availability - Graphs

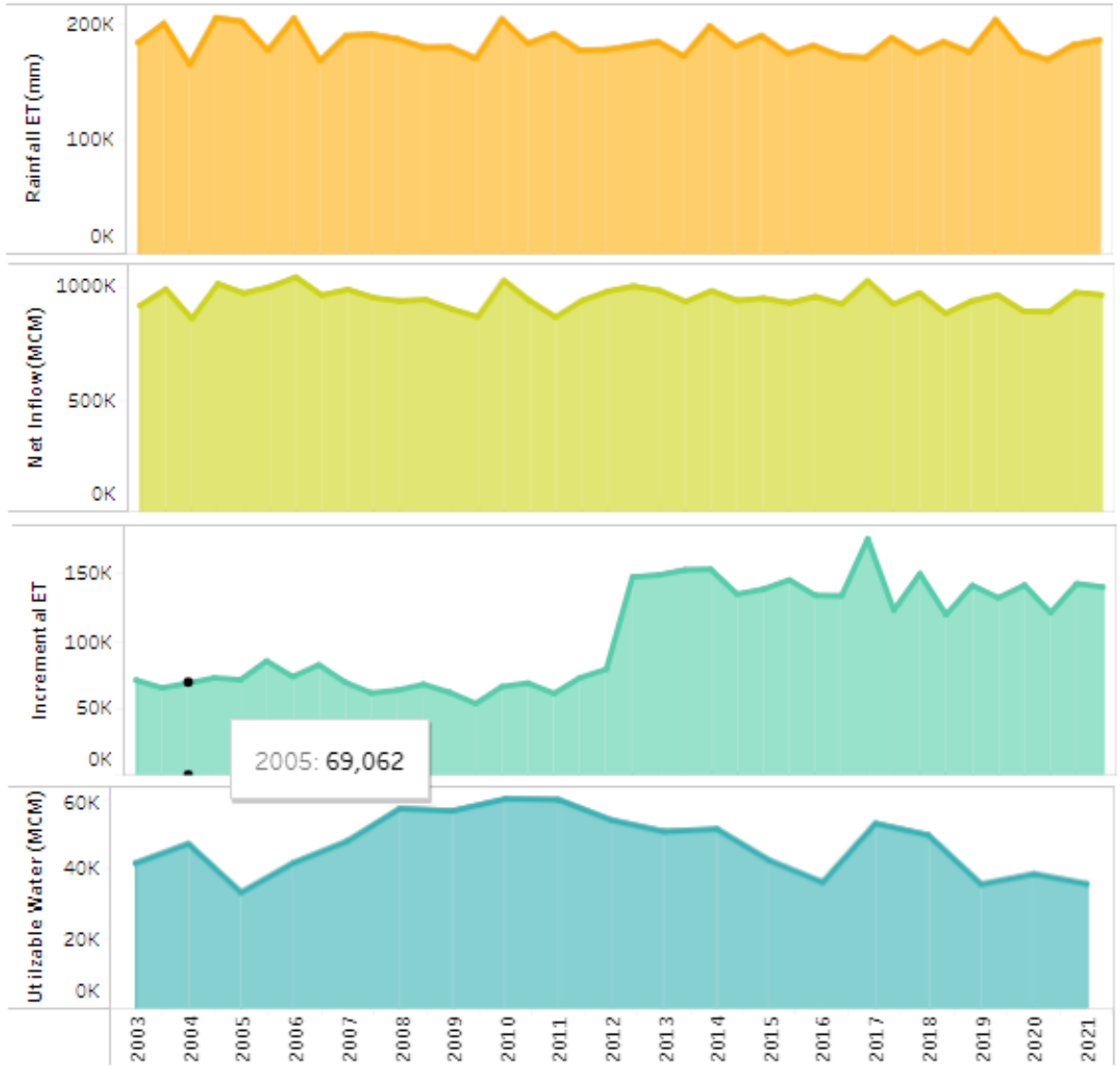


- Rainfall – measured in millimetres and is provided as an annual average of the basin or a selected district.
- ET mean – an outflow and is also measured in millimetres and it is the actual water lost to the atmosphere from plant and other surfaces.
- Storage change – provides information on water that is lost or gained to ground water. It is measured in million cubic metres (MCM).

Water Indicators Page

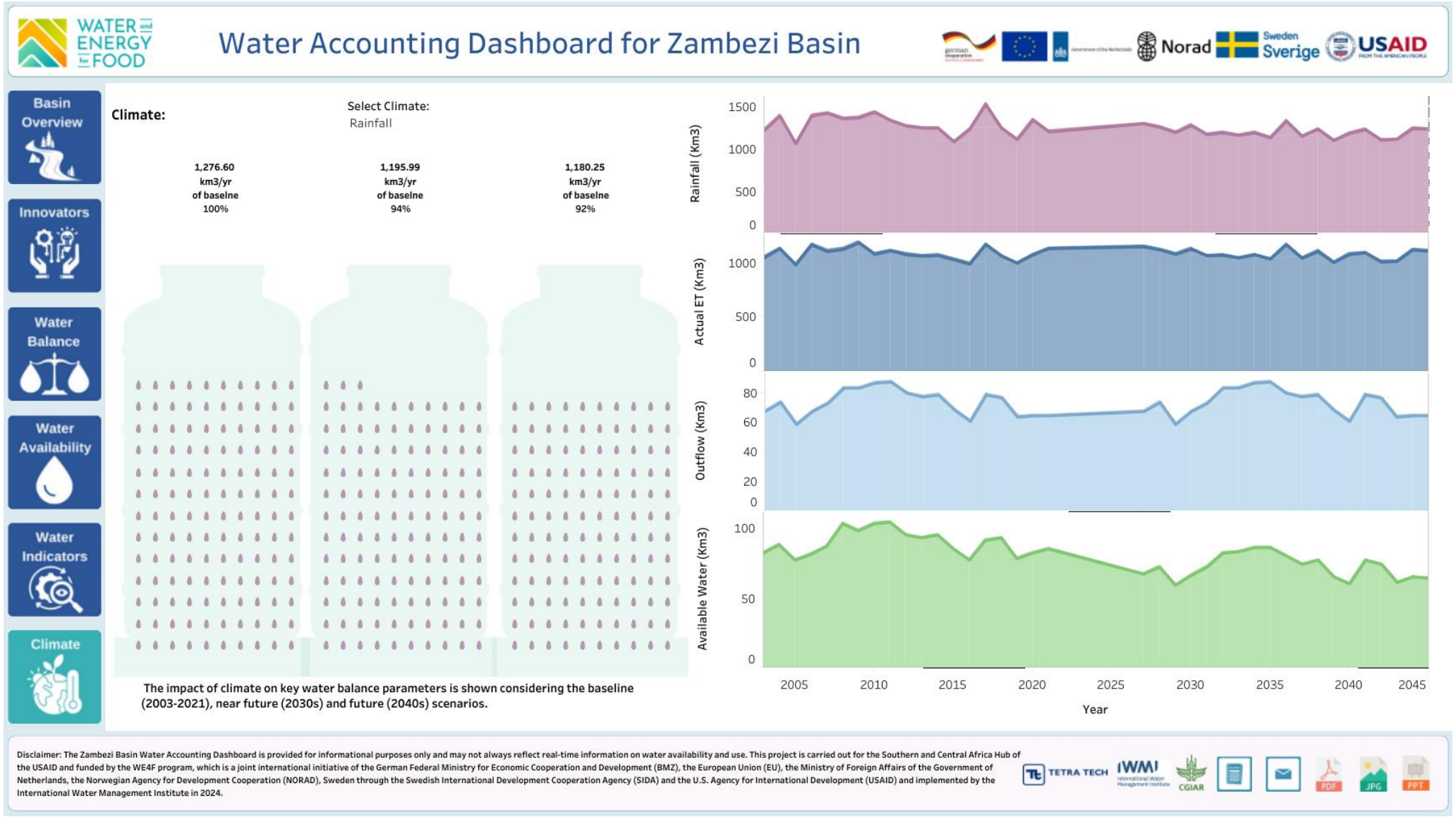


Water Indicators

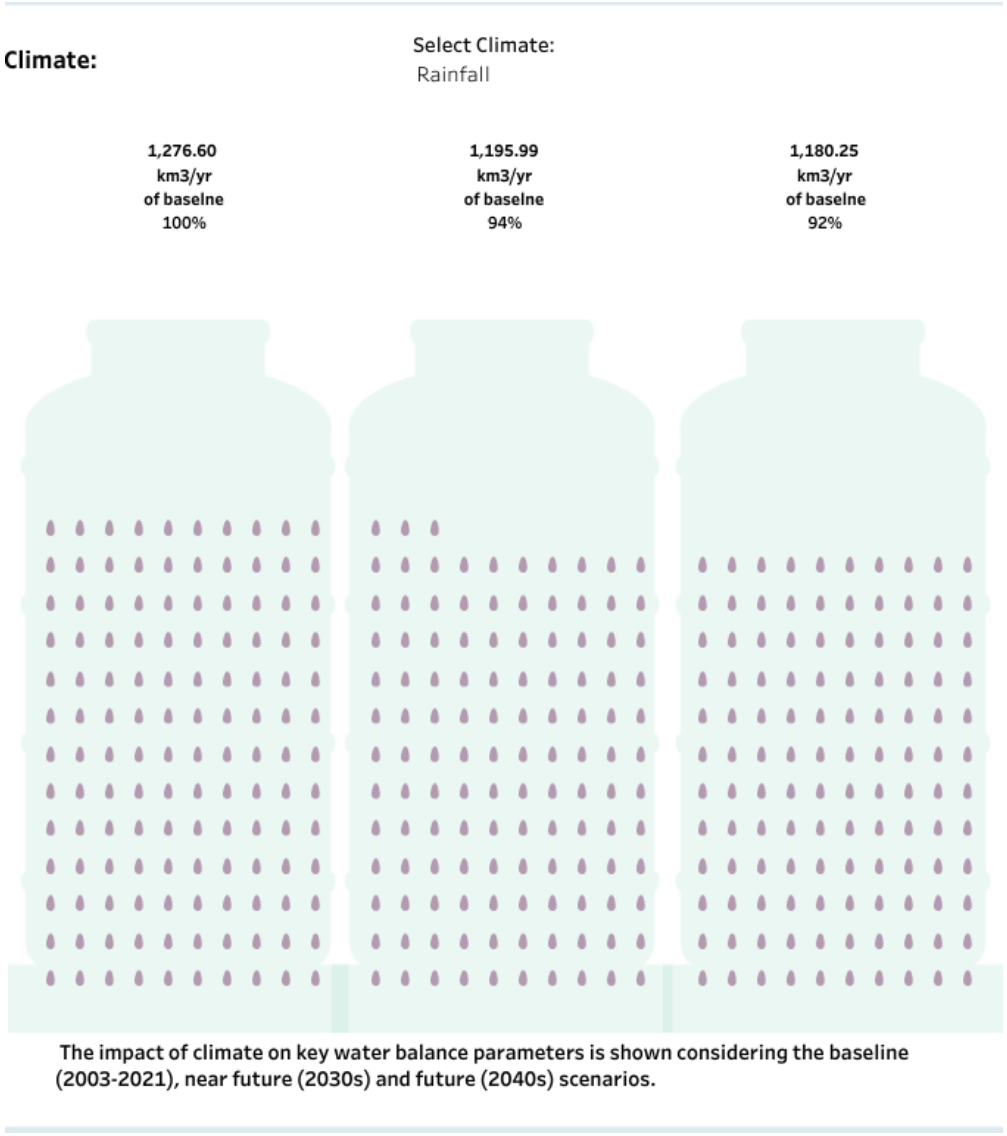


- Rainfall ET – ET of green water. A fraction of actual total ET that is due to precipitation
- Incremental ET – ET of blue water. A fraction of total ET that is not due to rainfall
- Net inflow – summation of gross inflow (precipitation plus any other inflows from surface or ground water that originate from outside the basin) and storage change.
- Utilizable outflow – water available for further water resources development after meeting all the basin demands of nature via lands cape evapotranspiration, rainfed agriculture, domestic and industrial demand and irrigated water use.

Future Climate Scenarios Page

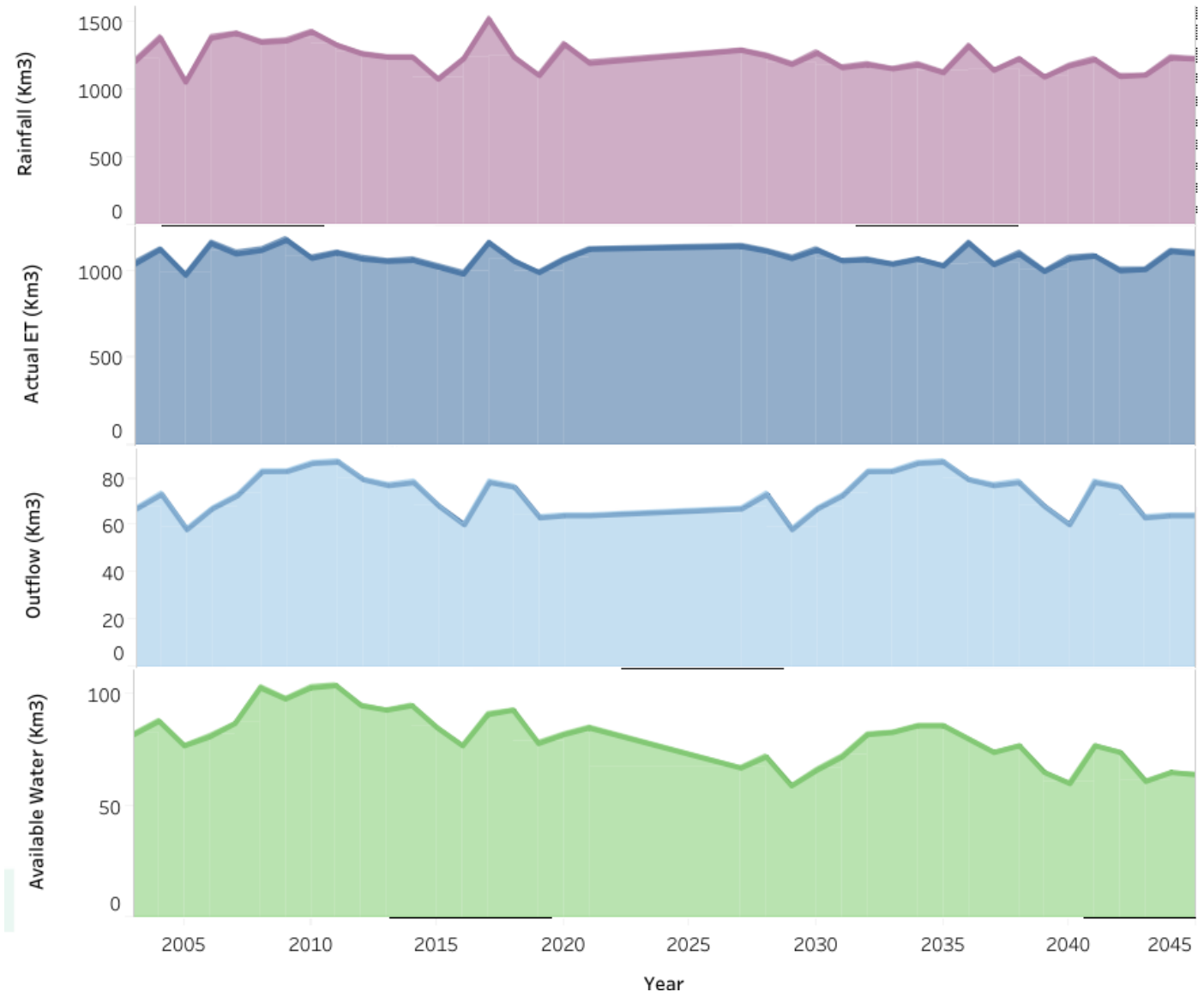


Future Climate Scenarios



- Shows the comparison of future rainfall, ET, Outflow and Water availability against the baseline period.
- The first bucket on the right represents the baseline period
- The two buckets on the left represent the near future (2030s) and the future (2040s)

Future Climate Scenarios - Charts



- ET – an outflow measured in millimetres, and it is the actual water lost to the atmosphere from plant and other surfaces.
- Rainfall – measured in millimetres and is provided as an annual average of the basin or a selected district.
- Outflow – measures in km2 and is the water that flows out at the mouth of the river. For the Zambezi, this is where the Zambezi flows into the Indian Ocean.
- Water availability – available water for use within the basin after the non-utilizable water and the environmental water requirements have been removed.