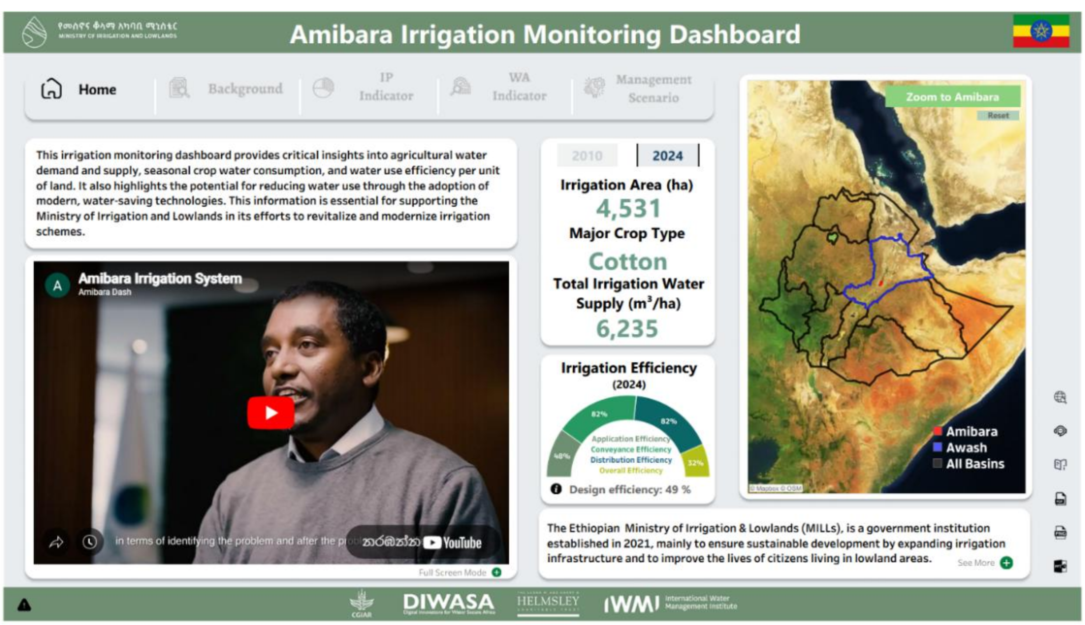
User Manual – Amibara Irrigation Monitoring Dashboard

01. What is a Irrigation Monitoring Dashboard ?

An **irrigation monitoring dashboard** is a digital tool that displays real-time or historical information about irrigation systems, water usage, and related environmental factors. It helps farmers, water managers, and decision-makers **visualize, track, and manage irrigation efficiently**. The dashboard integrates data from multiple sources, such as weather stations, soil moisture sensors, satellite imagery, and flow meters, and presents it in an easy-to-understand format using charts, maps, and tables.

Key purposes of an irrigation monitoring dashboard:

1. **Monitor Water Usage:** Shows how much water is being applied to fields and helps prevent over- or under-irrigation.
2. **Track Soil and Crop Health:** Uses sensor or satellite data to monitor soil moisture, evapotranspiration, and crop conditions.
3. **Improve Efficiency:** Helps optimize irrigation schedules, saving water and energy while maintaining crop productivity.
4. **Support Decision-Making:** Provides actionable insights for farmers and water managers to plan irrigation, detect leaks, or forecast water demand.
5. **Visualization and Reporting:** Converts complex data into visual charts, graphs, and maps for easy interpretation.



02. Key Elements of Dashboard

The Amibara Irrigation Monitoring Dashboard is an interactive tool developed to monitor, analyze, and visualize irrigation scheme performance in the Amibara area. It integrates field observations, hydrological data, and spatial maps to support decision-making for irrigation management.

There are five key elements in the dashboard:

i) Home
ii) Background
iii) IP Indicator
iv) WA indicator
v) Management Scenario

Figure 1 Dashboard Tabs

01. Home Page – Amibara Irrigation Monitoring Dashboard

1.1. Overview of the Irrigation Monitoring Dashboard

This dashboard provides key insights into water demand and supply, seasonal crop water use, and water use efficiency. It helps identify opportunities for water savings through modern irrigation practices and supports the Ministry of Irrigation and Lowlands in managing and modernizing irrigation schemes effectively.

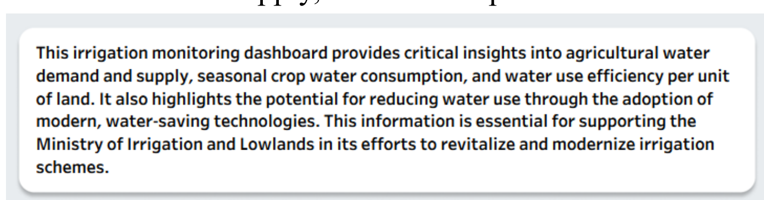

This irrigation monitoring dashboard provides critical insights into agricultural water demand and supply, seasonal crop water consumption, and water use efficiency per unit of land. It also highlights the potential for reducing water use through the adoption of modern, water-saving technologies. This information is essential for supporting the Ministry of Irrigation and Lowlands in its efforts to revitalize and modernize irrigation schemes.

Figure 2 The description of the basin provided in the Irrigation monitoring dashboard overview page

1.2 Video Section

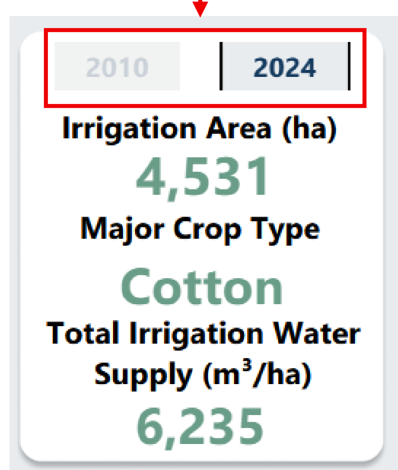
Embedded video explaining the Amibara irrigation system, providing users with a visual and verbal overview of irrigation management practices.

View video in full screen mode

1.3 Key Indicators

The Key Indicators section serves as a high-level summary of the most critical metrics for monitoring and managing irrigation systems. It is designed to provide users with immediate insights into the status of irrigated agriculture, helping to make informed decisions efficiently.

Click here change years

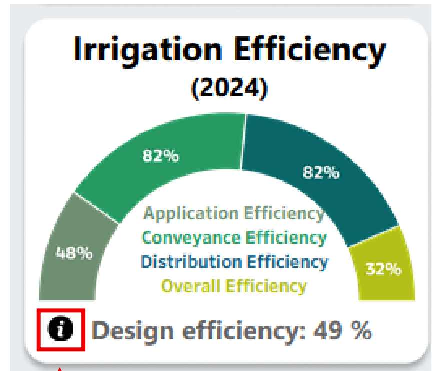


- **Irrigation Area (ha):** Represents the total land area currently receiving irrigation. This metric is crucial for understanding the extent of irrigated farming, planning water allocation, and assessing the coverage of irrigation infrastructure. It also helps in monitoring expansion or reduction of irrigated areas over time.
- **Major Crop Type:** Displays the dominant crop cultivated within the irrigated area. Knowing the main crop type is essential because different crops have varying water requirements, growth cycles, and sensitivities to water stress. This information helps optimize irrigation schedules and prioritize water resources according to crop needs.
- **Total Irrigation Water Supply (m^3/ha):** Indicates the amount of water supplied per hectare of irrigated land. This metric reflects water use efficiency, adequacy of supply, and helps identify areas that may be under- or

over-irrigated. By tracking this indicator, users can ensure sustainable water management and prevent water wastage.

1.4 Irrigation Efficiency Gauge

Visualizes overall irrigation efficiency and its components, including application, conveyance, and distribution efficiencies, helping users understand how effectively water is being used.

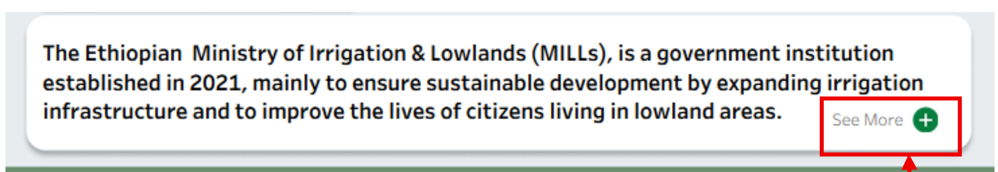


Click for definition and more information

01. **Design efficiency** refers to the efficiency parameters that are targeted and selected by designer when planning and creating an irrigation system.
02. **Conveyance efficiency** reflects how effectively water is delivered from its source to the farm gate, highlighting any losses that occur during transport.
03. **Application efficiency**, by contrast, measures how much of the applied irrigation water is stored in the root zone and available to crop.
04. **Overall efficiency** is the multiplication of Conveyance efficiency, application and distribution efficiency.

1.5 Ministry Information Box

Provides background about the Ethiopian Ministry of Irrigation & Lowlands, its establishment, and its role in sustainable irrigation and improving lives in lowland areas.



Click here to direct MILLs website

Figure 3 MILLS Information

1.6 Map Location

The interactive map displays the location of the Amibara irrigation scheme within the Awash Basin and Ethiopia. Users can zoom in and out or pan across the map to view specific areas, making it easier to understand the spatial distribution of water resources, irrigation schemes, and surrounding basins.

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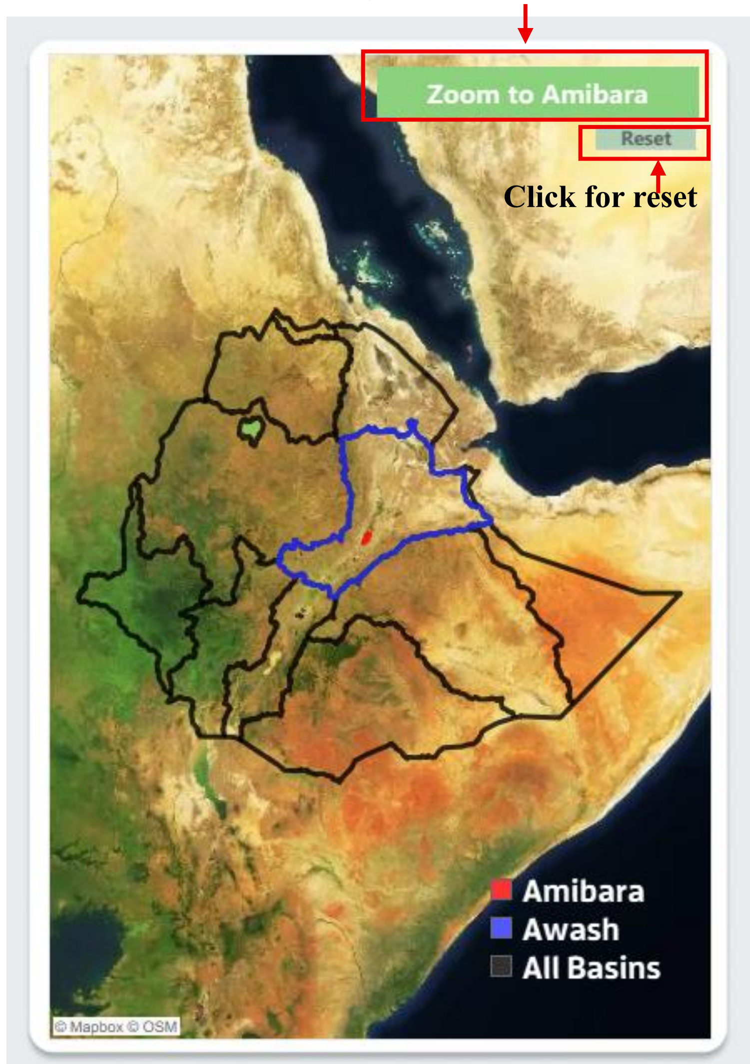
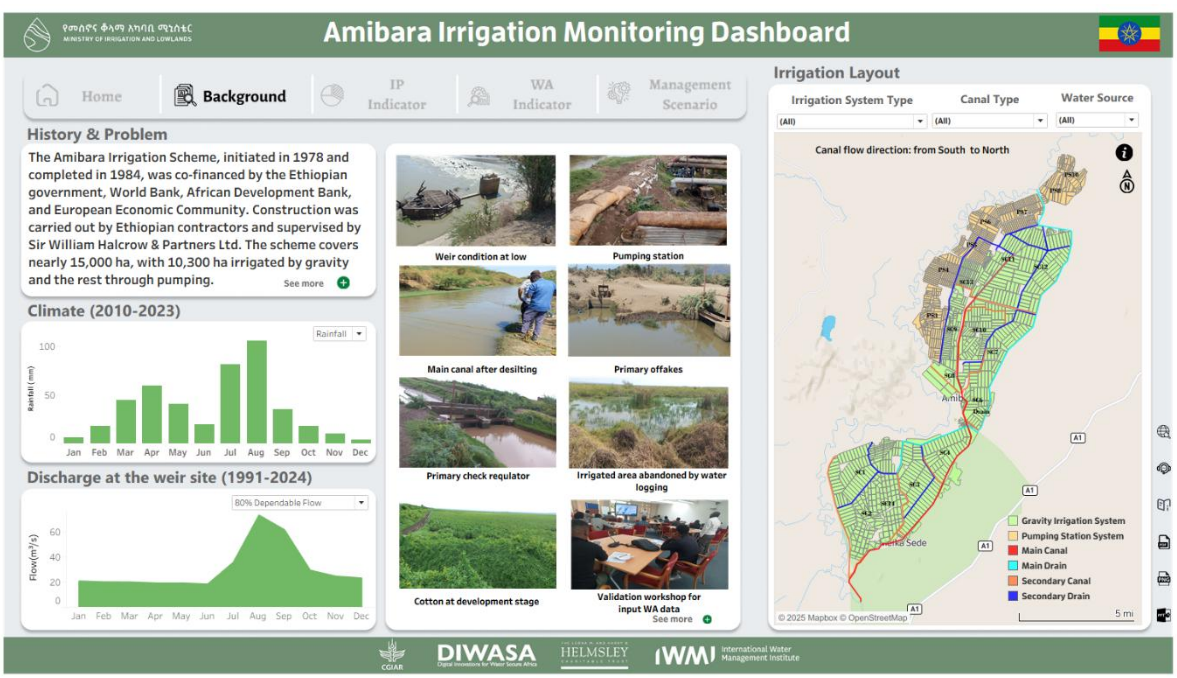
Click Zoom to Amibara

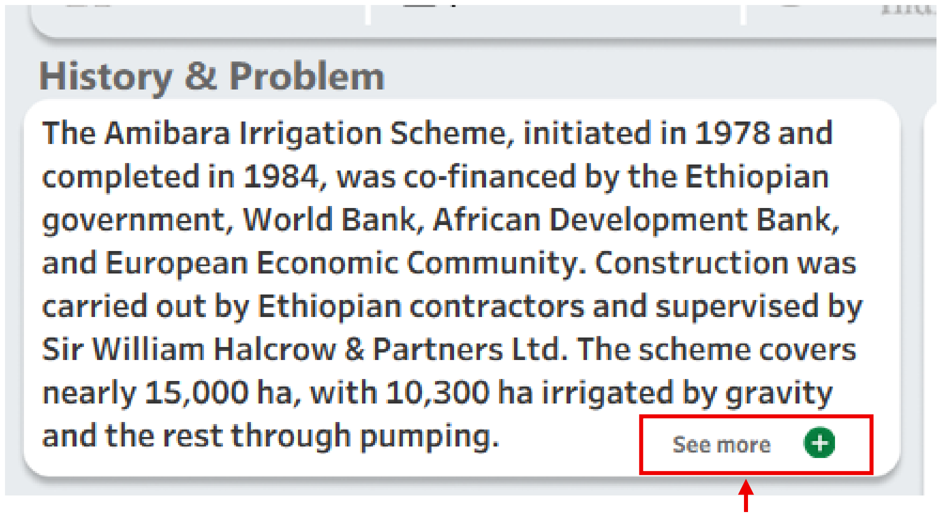


Click for reset

02.Background page



2.1 History and Problem



Click Here for Navigate to more history

The **History and Problem** section of the dashboard provides users with essential background information about the Amibara Irrigation Scheme. It outlines the origins of the scheme, which was initiated in 1978 and completed in 1984, and describes how it was co-financed by the Ethiopian government along with the World Bank, African Development Bank, and European Economic Community. The section also notes that construction was carried out by Ethiopian contractors under the supervision of Sir William Halcrow & Partners Ltd. In terms of scale, the scheme covers nearly 15,000 hectares, of which approximately 10,300 hectares are irrigated through gravity while the rest depend on pumping. In addition to presenting this historical context, the section highlights ongoing challenges such as waterlogging, the operational demands of pumping systems, and related management issues. Users can access this section to gain an overall understanding of the scheme's development, scope, and the key problems that continue to affect its performance.

2.2 Climate Data Bar Chart (2010–2023 Average)

By visualizing long-term average climate data, this chart helps farmers, water managers, and planners anticipate **seasonal water availability, irrigation demand, and crop stress periods** to improve water-use efficiency in the irrigation scheme.

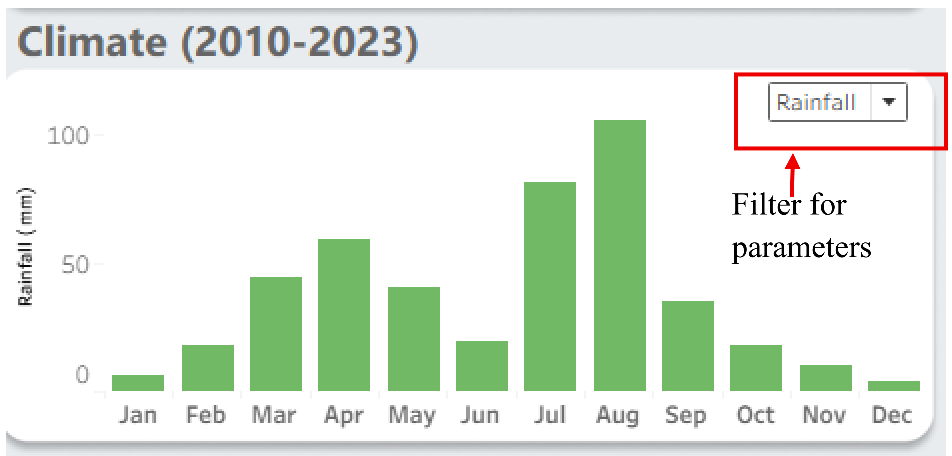
This interactive bar chart presents key climate indicators averaged across the years **2010 to 2023**, displayed on a **monthly basis**. Users can explore seasonal climate patterns relevant to irrigation planning.

- **Rainfall**: Shows the monthly average rainfall, helping to understand wet and dry periods.

- **Maximum Temperature (Tmax)**: Displays average monthly peak temperatures, useful for analyzing heat stress on crops.
- **Minimum Temperature (Tmin)**: Highlights the average lowest monthly temperatures, providing insights into cooler periods.
- **Reference Evapotranspiration (ET0)**: Indicates the water demand of crops under standard conditions, supporting irrigation requirement assessments.

Interactive Features:

- All climate parameters are available in a **single plot**.
- A **filter option** allows users to select and view any parameter individually or compare them dynamically.
- This flexibility supports decision-making by enabling users to focus on specific climate drivers of crop water needs.



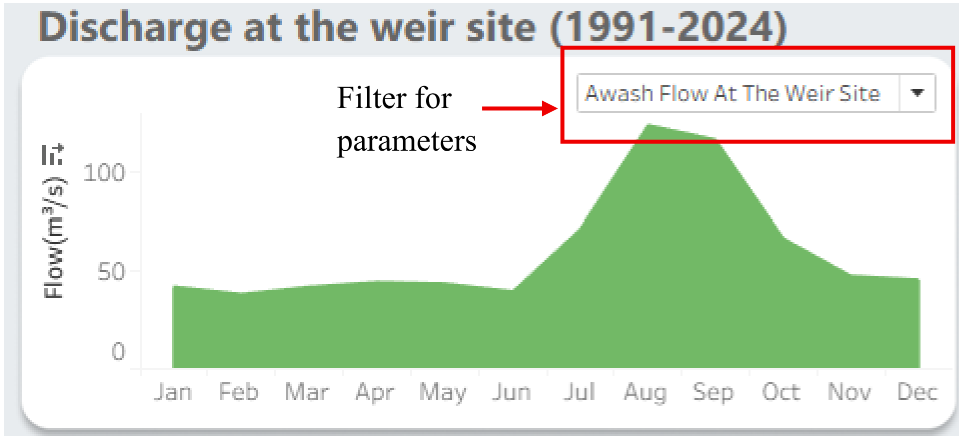
2.3 Discharge at Weir Site (1991–2024)

This chart displays long-term discharge data at the weir site, covering the period **1991 to 2024**. It provides key flow indicators that are critical for understanding water availability for irrigation and system management.

- **80% Dependable Flow**: Represents the minimum flow that can be expected 80% of the time, ensuring reliable planning for irrigation under varying hydrological conditions.
- **Weir Intake Capacity**: Shows the designed intake capacity of the weir structure, indicating how much water can be diverted for irrigation purposes.
- **Awash Flow at Weir Site**: Displays the actual river flow measured at the weir location, helping to compare natural flow against intake capacity and dependable flow levels.

Interactive Features:

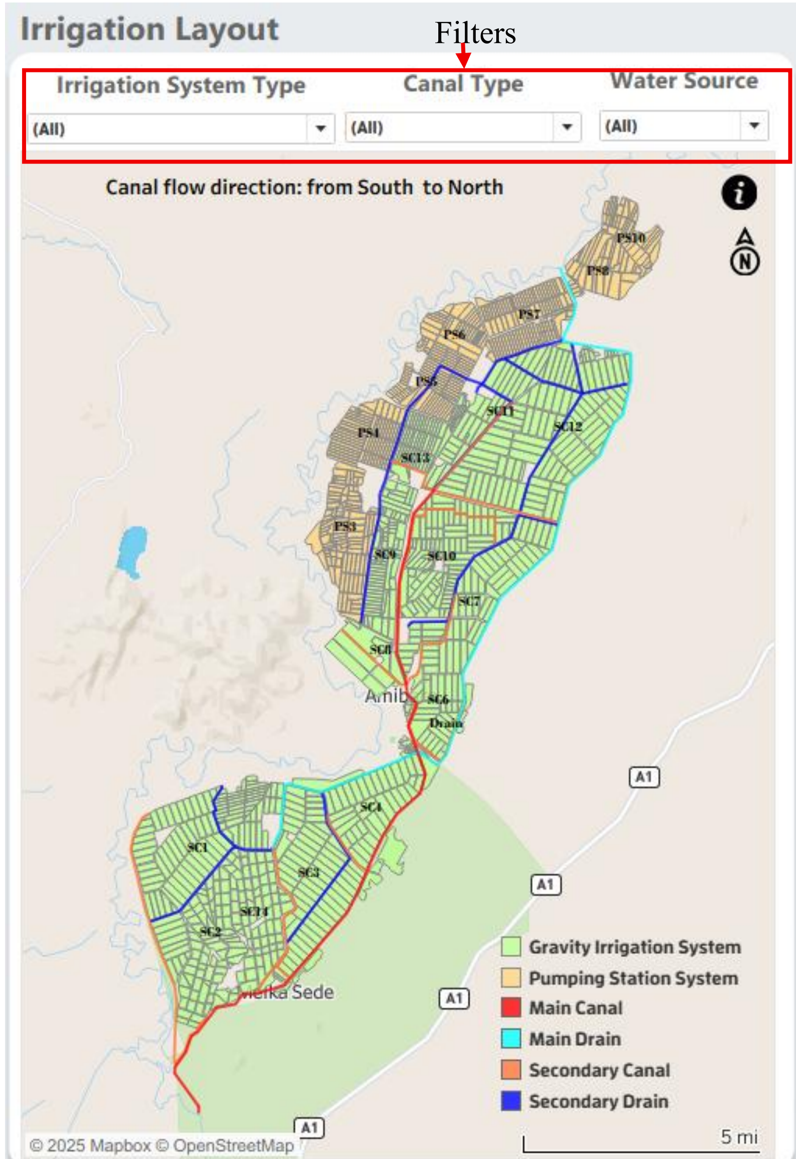
- Users can apply **filters** to switch between different flow parameters.
- The chart enables direct **visual comparison** between dependable flow, intake capacity, and actual river discharge over time.



2.4 Photo Gallery

This section provides a visual overview of the irrigation scheme and related field activities. Users can **click on any image** to view it in **full size**, allowing for a closer look at infrastructure, field conditions, and ongoing operations.

2.5 Irrigation Layout



The **Irrigation Layout** map provides a spatial overview of the irrigation scheme, showing the distribution of **blocks, canal types, and water sources**.

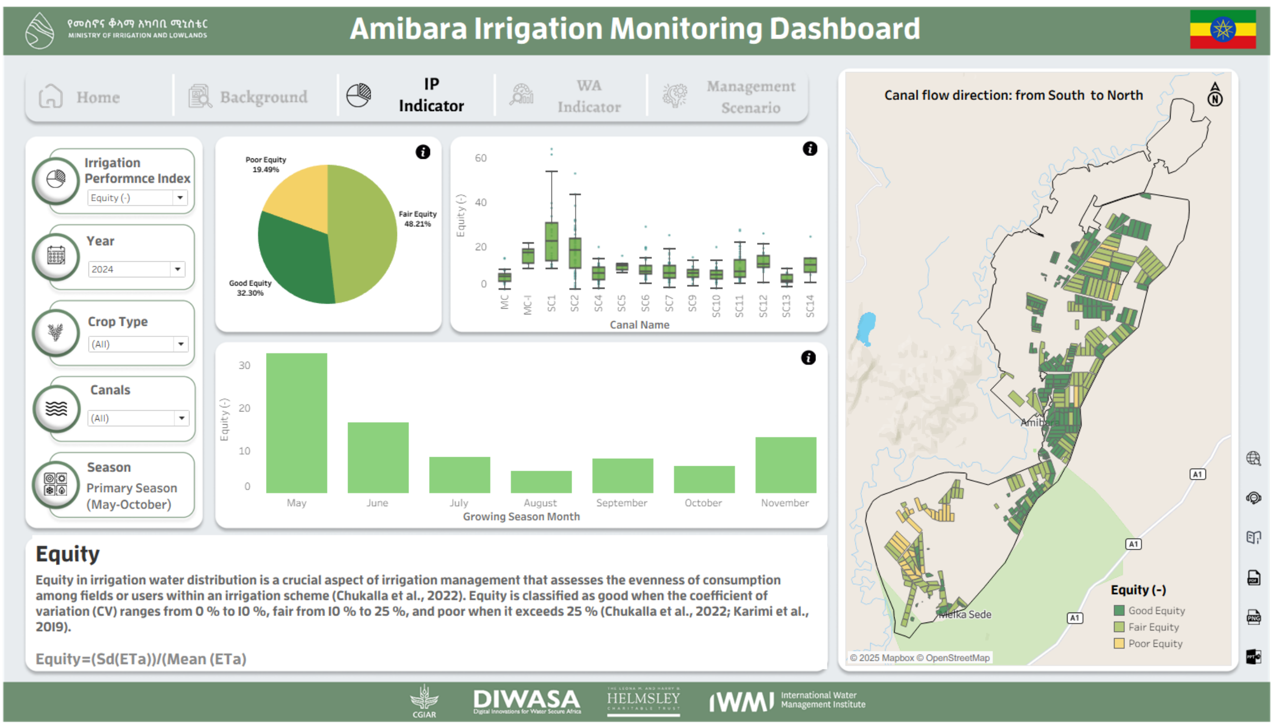
- Users can **filter** by these three parameters to view specific components of the irrigation system.
- By clicking on a block, users can access a **popup with detailed information** about that block (e.g., area, crops, water allocation).

This interactive map helps managers and stakeholders understand how water is distributed and managed within the scheme.

- ✓ **Irrigation Layout**: A schematic or map that shows the arrangement of irrigation infrastructure, including canals, blocks, and water sources, designed to manage and distribute water efficiently.
- ✓ **Gravity Irrigation System**: A method of conveying water to fields using natural ground slope, without the need for pumping, making it energy-efficient and cost-effective.
- ✓ **Pumping Station**: An engineered facility equipped with pumps that lifts water from rivers, reservoirs, or underground sources to supply the irrigation system where gravity flow is not sufficient.
- ✓ **Main Canal**: The primary channel that conveys water from the water source (weir, reservoir, or pumping station) into the irrigation network.

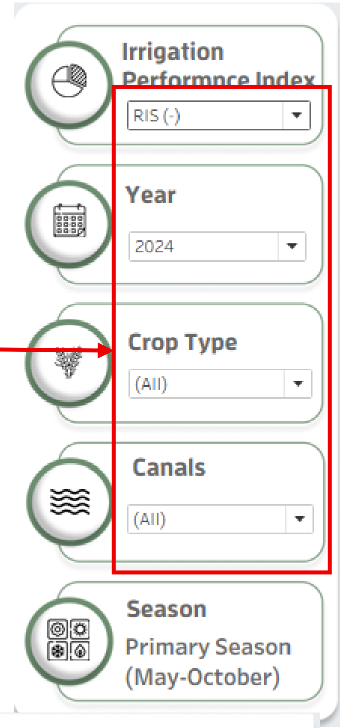
- ✓ **Secondary Canal**: Smaller channels branching from the main canal to deliver water to specific irrigation blocks or fields.
- ✓ **Drain**: A channel designed to remove excess or waste water from the irrigation area, preventing waterlogging and salinity.
- ✓ **Secondary Drain**: Smaller drainage channels that connect local field drains to the main drain for effective removal of surplus water.

03. IP Indicator page



3.1 Filters & Controls

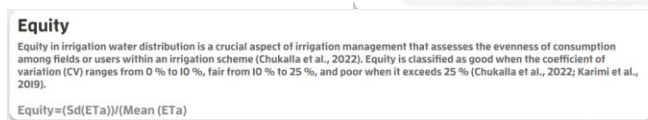
The left panel of the dashboard provides several filters that allow users to customize the displayed data according to their needs. The **Irrigation Performance Index** can be analyzed through different parameters including **Equity, Relative Evapotranspiration, Relative Irrigation Supply, and Irrigation**. These indicators help assess the efficiency and fairness of water distribution across the scheme. Users can also select the **Year** of analysis, with available data ranging from **2010 to 2024**, making it possible to compare historical and recent irrigation performance. The **Crop Type** filter allows users to focus on specific crops such as **cotton** and **vegetables**, which are the main cultivated crops in the Amibara scheme. Additionally, the **Canals** filter enables users to either analyze all canals together or select a specific canal for detailed monitoring. Finally, the **Season** filter provides the option to view performance during the Primary Season (May–October) allowing for seasonal comparisons of irrigation practices and water availability.



Select a parameter, year and crop and canal

3.2 Definition and Fraction of Each Parameter

This section provides a brief explanation and fractional representation of each parameter used in the analysis. The **definition** describes what the parameter measures or represents, while the **fraction** indicates its proportional contribution or weight in the dataset. Together, these help in understanding the role and significance of each parameter in evaluating variations during the selected crop-growing season.



Equity

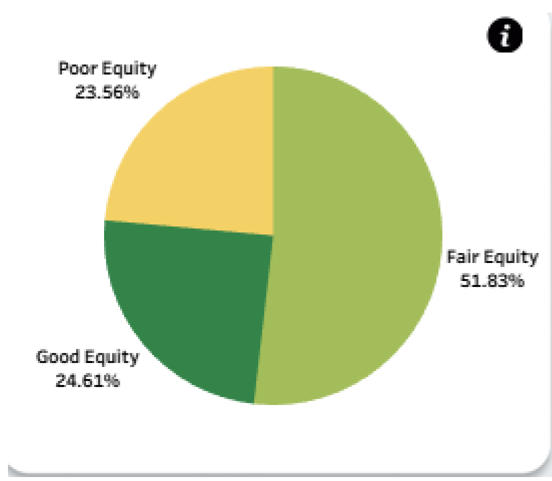
Equity in irrigation water distribution is a crucial aspect of irrigation management that assesses the evenness of consumption among fields or users within an irrigation scheme (Chukalla et al., 2022). Equity is classified as good when the coefficient of variation (CV) ranges from 0 % to 10 %, fair from 10 % to 25 %, and poor when it exceeds 25 % (Chukalla et al., 2022; Karimi et al., 2019).

Equity=(Sd(ETa))/(Mean (ETa)

The **definition section** located below the visualizations provides a clear explanation of the selected **Irrigation Performance indicators**, helping users interpret what the displayed values represent

3.3 Pie chart

This pie chart illustrates the percentage distribution of each parameter across different levels. It visually represents how each parameter contributes proportionally within the dataset, making it easier to compare their relative significance and identify which levels dominate or have lesser representation.

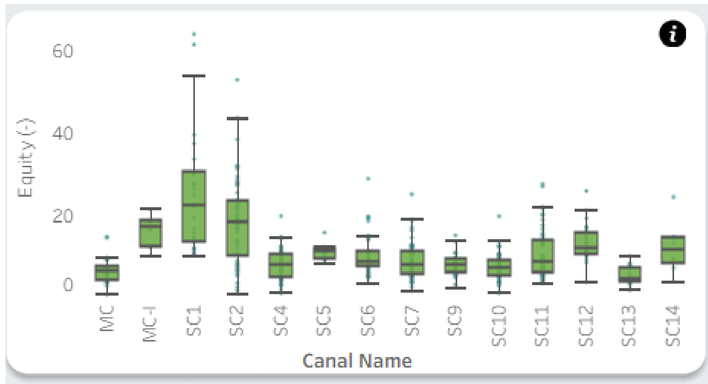


This chart is fully **interactive and dynamically linked to the filters** on the left panel. When users adjust filters such as **Indicator, Year**, **Crop Type**,

Canal, or **Season**, the chart automatically updates to display values relevant to the selected conditions.

3.4 Box plot

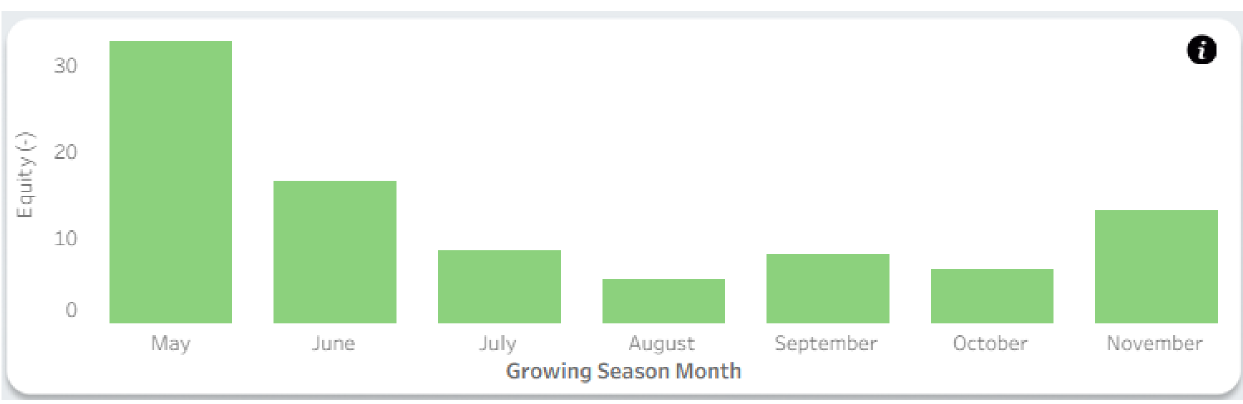
This box plot displays the distribution of each parameter across different canals. It shows how parameter values vary canal-wise, highlighting the median, quartiles, and possible outliers. This visualization helps compare variations and identify trends or anomalies among the canals.



This chart is fully **interactive and dynamically linked to the filters** on the left panel. When users adjust filters such as **Indicator, Year**, **Crop Type**, **Canal**, or **Season**, the chart automatically updates to display values relevant to the selected conditions.

3.5 Bar Chart

This bar chart illustrates the variation of each parameter during the selected crop-growing season. It highlights how parameter values change over time within the season, allowing comparison between different parameters and identifying key trends that influence crop growth.

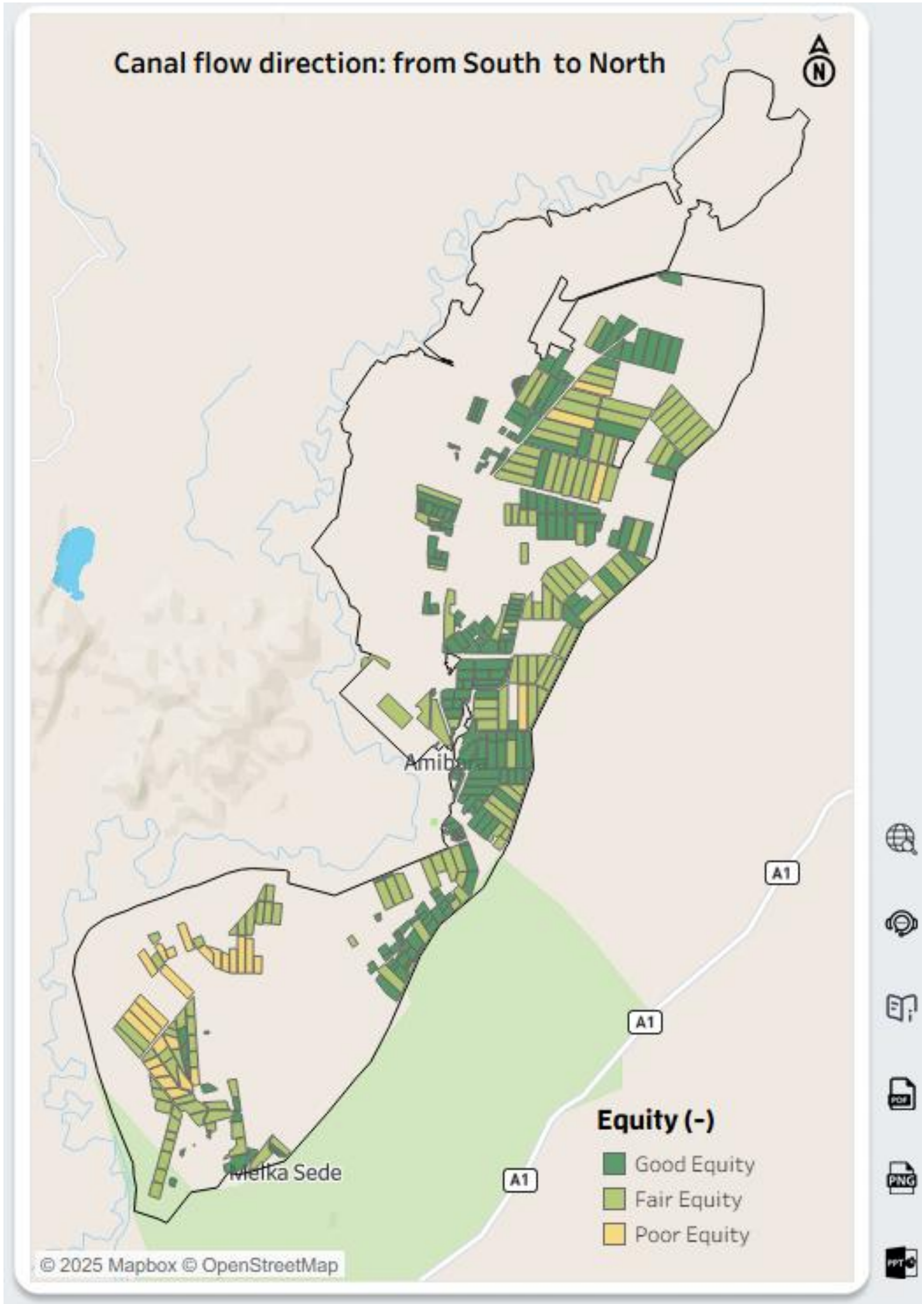


This chart dynamically updates based on the selected **Indicator**, **Year**, **Canal**, and **Crop Type** filters.

3.6 Map

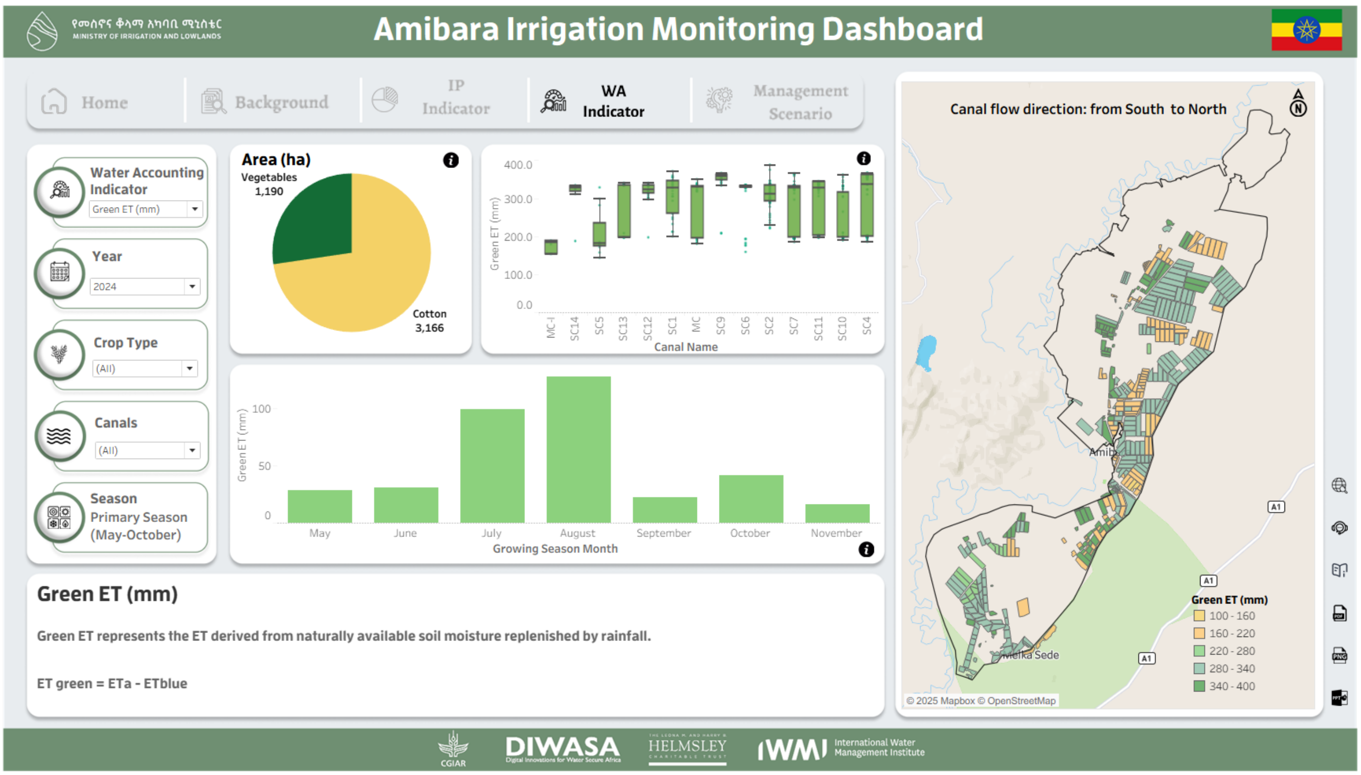
The map section is designed to display the spatial distribution of all parameters with interactive filtering options. Users can dynamically explore the data by selecting specific **parameters**, **years**, and **crop types**. As filters are applied, the map automatically updates to reflect the relevant data, allowing users to visualize how each parameter changes geographically across different conditions and time periods.

Map Section **Indicator**, **Year**, **Canal**, and **Crop Type** are fully interactive and directly control what is displayed on the **map**.



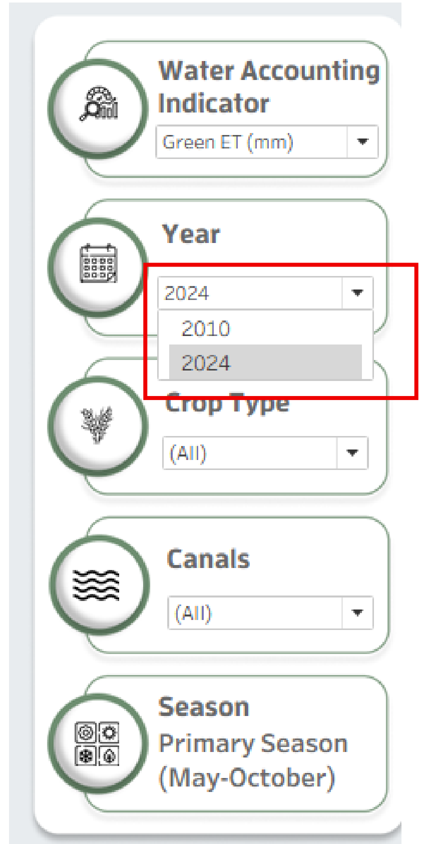
4. Water Accounting Indicator Page

This dashboard provides an interactive visualization of Water Accounting indexes across the Amibara command area. It allows users to monitor crop water use, canal performance, and spatial distribution of water accounting indicators such as **Green ET ,Blue ET and Beneficial fraction**.



4.1 Filters & Controls

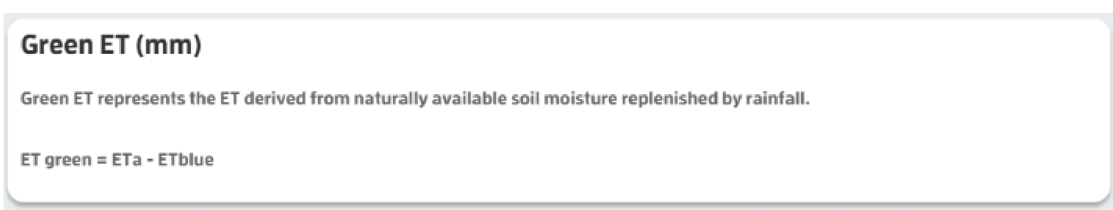
The left panel of the dashboard provides several filters that allow users to customize the displayed data according to their needs. The **Water Accounting indexes** can be analyzed through different parameters including **Blue Et, Green ET, And Beneficial fraction** . These indicators help assess the efficiency and fairness of water distribution across the scheme. Users can also select the **Year** of analysis, with available data ranging from **2010 to 2024**, making it possible to compare historical and recent irrigation performance. The **Crop Type** filter allows users to focus on specific crops such as **cotton** and **vegetables**, which are the main cultivated crops in the Amibara scheme. Additionally, the **Canals** filter enables users to either analyze all canals together or select a specific canal for detailed monitoring. Finally, the **Season** filter provides the option to view performance during the Primary Season (May–October) allowing for seasonal comparisons of irrigation practices and water availability.



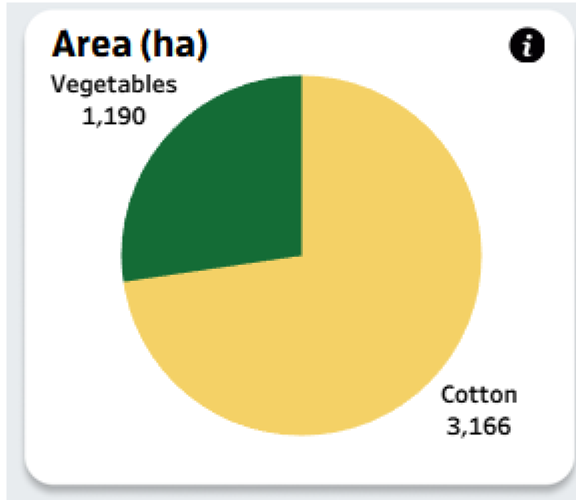
4.1 Definition and Fraction of Each Parameter

This section provides a brief explanation and fractional representation of each parameter used in the analysis. The **definition** describes what the parameter measures or represents, while the **fraction** indicates its proportional contribution or weight in the dataset. Together, these help in understanding the role and significance of each parameter in evaluating variations during the selected crop-growing season.

The **definition section** located below the visualizations provides a clear explanation of the selected **Water Accounting Indicator**, helping users interpret what the displayed values represent.



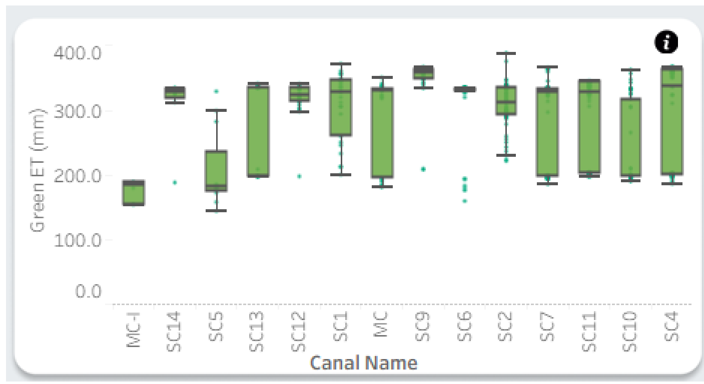
4.2 Pie Chart



This pie chart illustrates the proportion of different crops cultivated each year, showing their respective areas in hectares. It provides a visual comparison of how crop cultivation varies annually, highlighting which crops occupy larger or smaller areas within the selected years.

4.3 Box plots

This box plot displays the distribution of each parameter across different canals. It shows how parameter values vary canal-wise, highlighting the median, quartiles, and possible outliers. This visualization helps compare variations and identify trends or anomalies among the canals.

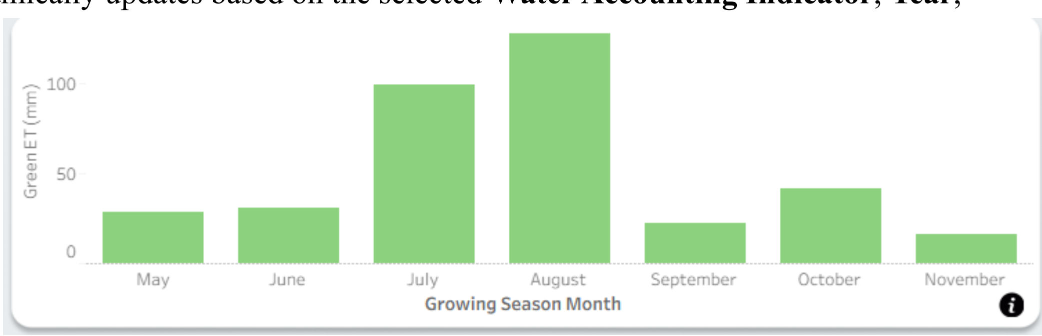


This chart is fully **interactive and dynamically linked to the filters** on the left panel. When users adjust filters such as **Year**, **Crop Type**, **Canal**, or **Season**, the chart automatically updates to display values relevant to the selected conditions. For instance, filtering by a specific crop like *Cotton* or *Vegetables* will show how that particular crop's water use pattern changes, while selecting a specific canal will highlight spatial variations in evapotranspiration within that area. This interactive behavior helps users analyze seasonal water consumption trends.

4.5 Bar Chart

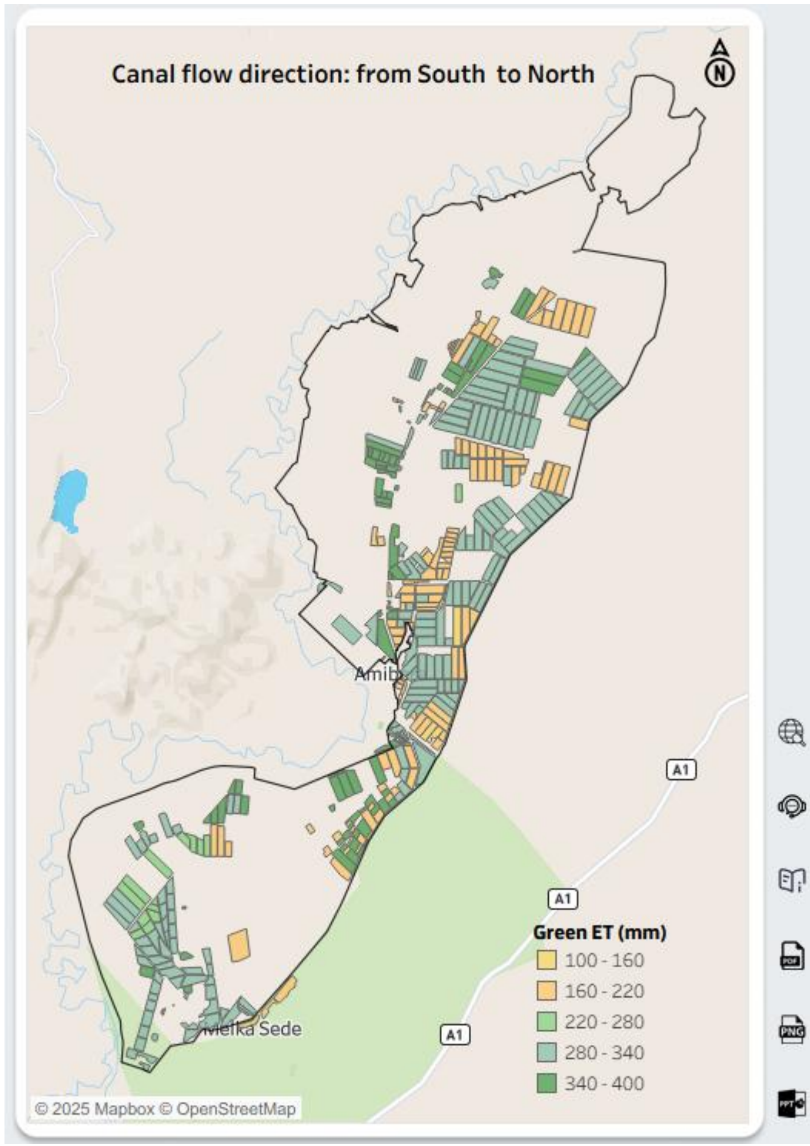
This bar chart illustrates the variation of each parameter during the selected crop-growing season. It highlights how parameter values change over time within the season, allowing comparison between different parameters and identifying key trends that influence crop growth.

This chart dynamically updates based on the selected **Water Accounting Indicator**, **Year**, **Canal**, and **Crop Type** filters. When a user changes the **indicator**, the chart reflects the



corresponding type (e.g., Green ET). Selecting a specific **year** refreshes the data for that monitoring period. Similarly, choosing a particular **crop type** (e.g., Cotton or Vegetables) tailors the chart to show the pattern for that crop alone. This interactive linkage between the chart and filters allows users to effectively analyze.

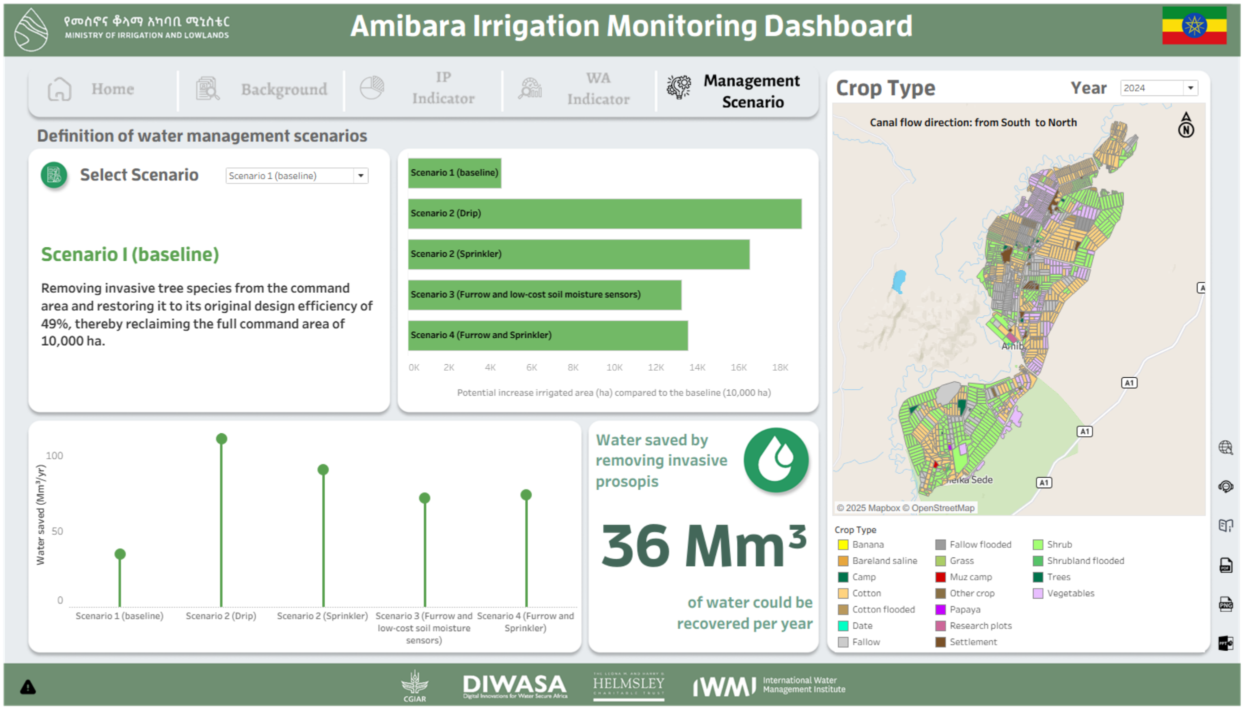
4.6 Map



The map section is designed to display the spatial distribution of all parameters with interactive filtering options. Users can dynamically explore the data by selecting specific **parameters**, **years**, and **crop types**. As filters are applied, the map automatically updates to reflect the relevant data, allowing users to visualize how each parameter changes geographically across different conditions and time periods.

The **filters** on the left panel of the dashboard namely **Water Accounting Indicator**, **Year**, **Canal**, and **Crop Type** are fully interactive and directly control what is displayed on the **map**. When a user selects a specific **indicator** the map updates to visualize that parameter spatially across the irrigation command area using a color gradient to represent different value ranges. Choosing a particular **year** refreshes the map to show data corresponding to that time period. Similarly, the **Canal** filter narrows down the map to display only the selected canal's command area. The **Crop Type** filter lets users focus on specific crops (such as Cotton or Vegetables).

6. Management Scenario



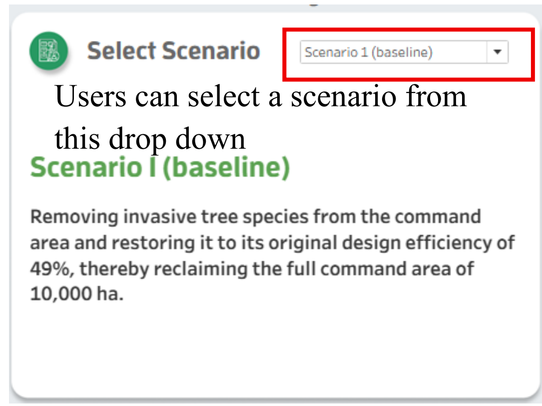
6.1 Definition of Water Management Scenarios

- **Components:**
  - **Dropdown menu ("Select Scenario"):** Users can choose from different water management scenarios.
  - **Scenario Description Box:** Displays detailed information about the selected scenario.

Scenario	Description
Scenario 1 (baseline)	Removing invasive tree species from the command area and restoring it to its original design efficiency of 49%, thereby reclaiming the full command area of 10,000 ha.
Scenario 2	Improving irrigation efficiency and increasing cropping intensity by shifting from furrow irrigation to sprinkler and drip systems. In this scenario, we assumed an overall irrigation efficiency of 75% for sprinkler systems and 85% for drip irrigation systems.
Scenario 3	This scenario involves furrow irrigation equipped with low-cost moisture sensors, aiming to enhance efficiency from 49% to 60%.
Scenario 4	A combination of furrow and sprinkler irrigation system. In this scenario, we considered 5000 ha for

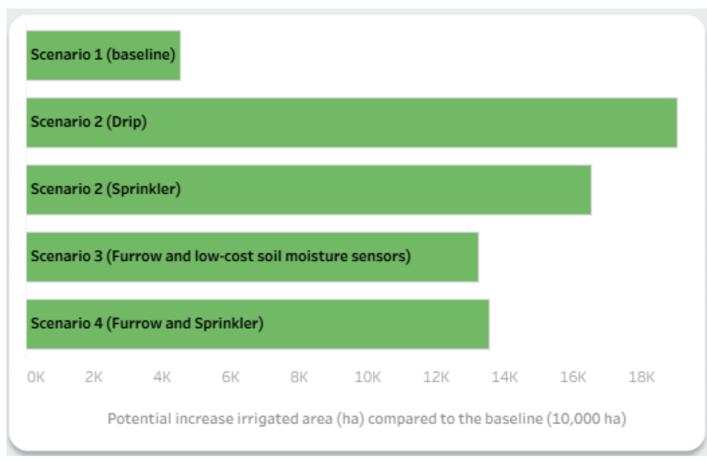
	furrow with efficiency of 60 % and 5000 ha for sprinkler with efficiency of 80 % with low-cost moisture sensor. This scenario balances improved water use efficiency with reduced investment costs by maintaining existing furrow systems while gradually introducing sprinkler technology.

- **User Interaction:**
  - Users can filter by selecting a **scenario** (Baseline, Drip, Sprinkler, etc.) from the dropdown.



6.2 Scenario Comparison Bar Chart

This chart provides a **visual comparison of the potential increase in irrigated areas (in hectares)** under different water management scenarios, relative to the **baseline condition (10,000 ha)**. It helps users quickly understand how implementing various irrigation technologies or practices can expand the effective irrigated area without increasing total water use.



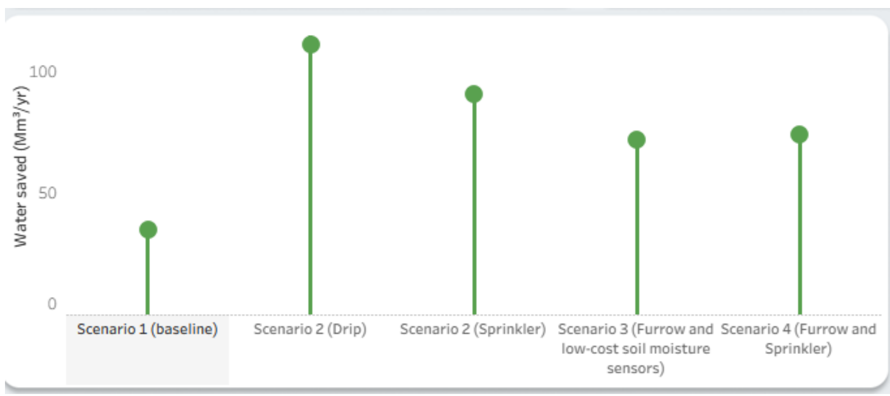
Description:

- Each **horizontal bar** represents one management scenario.
- The **length of the bar** corresponds to the **potential increase in irrigated area** that could be achieved compared to the baseline.
- The **baseline scenario** serves as a reference point (set at 10,000 ha), while other bars extend beyond this value to show potential improvements.
- The chart visually highlights which management practice is most efficient in utilizing available water resources.

Scenarios Displayed:

1. **Scenario 1 (Baseline)** – Current situation with existing irrigation efficiency (49%) and 10,000 ha command area.
2. **Scenario 2 (Drip)** – Uses drip irrigation systems that significantly improve water-use efficiency, leading to a larger irrigated area.
3. **Scenario 2 (Sprinkler)** – Employs sprinkler irrigation, improving uniformity and moderate efficiency gains.
4. **Scenario 3 (Furrow + Low-Cost Soil Moisture Sensors)** – Combines traditional furrow irrigation with affordable sensor technology for better water scheduling and reduced losses.
5. **Scenario 4 (Furrow + Sprinkler)** – Integrates both furrow and sprinkler systems for improved performance compared to conventional furrow methods.

6.3 Water Saved Chart



The Water Saved Chart visualizes the **volume of water saved per year (in million cubic meters, Mm^3/yr)** under each irrigation management scenario. It allows users to easily compare how different technologies or practices improve water efficiency across the Amibara irrigation command area.

Chart Description:

- The **Y-axis** is measured in **million cubic meters per year (Mm^3/yr)**, indicating the magnitude of potential water recovery.
- The **X-axis** lists the five management scenarios being compared:
    1. **Scenario 1 (Baseline):** Current conditions with low irrigation efficiency and minimal water savings.
    2. **Scenario 2 (Drip):** High-efficiency irrigation through drip systems, leading to maximum water conservation.

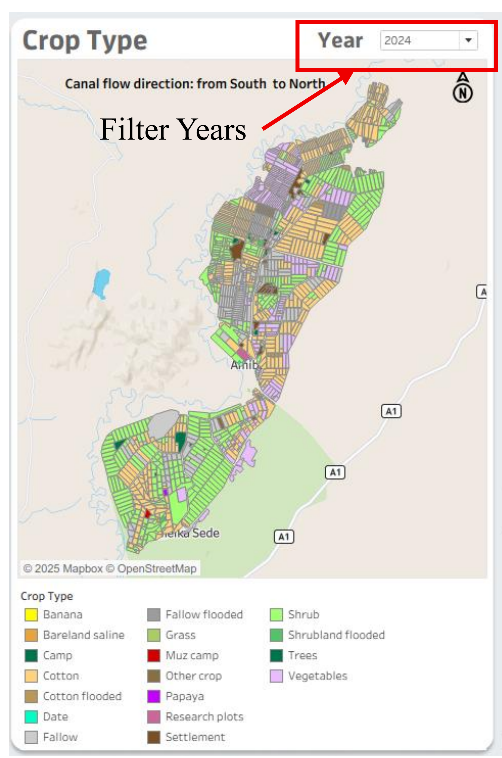
3. **Scenario 2 (Sprinkler):** Moderate water savings through improved irrigation distribution and reduced evaporation losses.
4. **Scenario 3 (Furrow + Low-Cost Soil Moisture Sensors):** Traditional furrow irrigation enhanced with soil moisture sensors to optimize irrigation timing, improving efficiency and saving water.
5. **Scenario 4 (Furrow + Sprinkler):** A hybrid approach that combines furrow and sprinkler irrigation methods for moderate water-use improvements.

6.4 Water Recovery Highlight

- **Key metric:** “Water saved by removing invasive prosopis – 36 Mm³ of water could be recovered per year.”
- Summarizes the total potential annual water recovery due to removing invasive tree species.

6.5 Crop type map

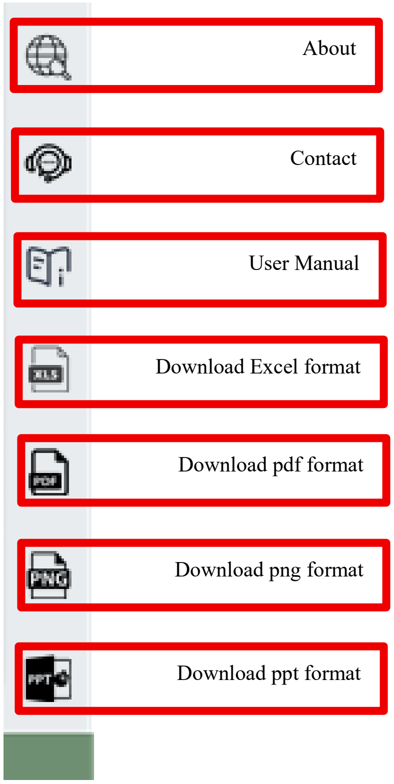
The **Crop Type and Spatial Map** provides a **geospatial visualization** of the Amibara Irrigation Scheme, showing how different crop types and land uses are distributed across the command area. It enables users to **interpret spatial patterns**, **assess land utilization**, and **understand irrigation coverage** in relation to water management practices.



Year Filter (Dropdown):

- Allows users to **switch between different years** (for example, 2010, 2024, etc.)

Additional features on the dashboard:



There are several additional features available on the dashboard. A brief description and purpose of each of the icons located on the lower left corner are presented here.

Contact: The contact icon is located on the lower right corner of the dashboard and it would provide email information on whom to contact in case you have any questions on the dashboard.

About: The about icon provides more info on the project.

Printing options: The dashboard can be printed or saved using three options. The current view of the dashboard can be saved to the local computer in three different formats – PDF, JPG or PPT and users can download data in excel format. Please use appropriate icon as per your need.