Annex 3.8

User guide for the AWMISET database

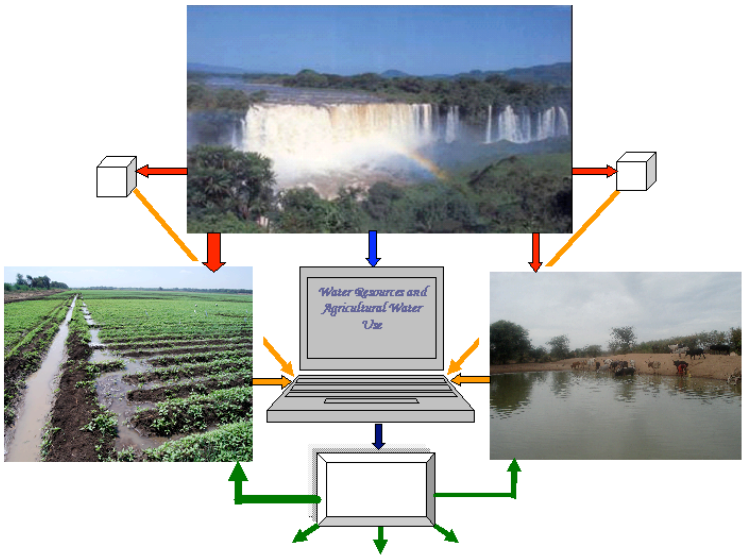
Ministry of Water Resources

Federal Democratic Republic of Ethiopia
Ministry of Water Resources

Food and Agricultural Organization of the United Nations

Project: Strengthening national water monitoring capacities, with emphasis on agricultural water management (GCP/GLO/207/ITA)

AGRICULTURAL WATER MANAGEMENT INFORMATION SYSTEM OF ETHIOPIA AWMISET



USER GUIDE

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1. INTRODUCTION

While modern irrigation development has been ongoing in Ethiopia dates since 1950s information on area developed under irrigation, water abstracted for irrigation and relevant socio-economics aspects as well as contribution of irrigated agriculture to food security and household and national economy is either lacking or inaccurate and inconsistent. Lack of accurate information on water use particularly on agricultural water use which takes the lion's share of water resources poses difficulties in proper planning and development of water-based programs and projects. The government has since recently given top priority for water resources development and improved water management in order to improve food security and promote economic growth. Monitoring is one major aspect of this development agenda accurate information irrigated area, agricultural water use and related environmental effects is be very imperative and a pre-requisite for making the right decision in order to enable informed-decision making .

It is on this background that this Agricultural Water Management Information System for Ethiopia (AWMISET) which deals with agricultural water management information with technical support of Food and Agriculture Organization (FAO) and financed by Italian Government has been developed in the Ministry of Water Resources. AWMISET is a web-based database on agricultural water use and area developed under irrigation and rainwater harvesting systems as well as relevant socioeconomics information. This information system is simple to operation through the use of menu-driven procedures. AWMISET can perform all data management activities including data entry and query of irrigation related indicators including irrigated area, estimated agricultural water withdrawal, and relevant environmental and socioeconomic information at country, region and river basin levels.

The country has adopted 26 water-related indicators out of which four are considered in this manual. Sub-indicators and others related to irrigation are also included.

AWMISET allows online data entry by users. For the sake of security against manipulation of information, data entry can be done by only those who will be registered with and given user name and password by the Ministry of Water Resources. Moreover, the system does not allow a privileged user of one region or river basin to manipulate data of another region or river basin.

This operation manual provides procedures for management and use of the database including exporting raw data by registered users and downloading processed information by all users.

2. OVERVIEW OF AWMISET INTERFACE, MENU AND FUNCTIONS

2.1 Conventions used in this Manual

a) Both data entry boxes and options which can be selected using the mouse from the data entry fields are always enabled.

b) Typing number is equally effective as selecting from the dropdown menus

2.2 The AWMISET Interface

The AWMISET **Home Page** (main menu screen) looks like in Figure 1.

1. The main menu system leads to the relevant pages as shown in Figures 1-4.
2. The system is designed such that a page can be accessed by more than one option.
3. A facility for returning to a previous page is also included.
4. The home page provides two main menus on the left of the page: **Contact Info (information** and **Agricultural Data** which are also accessed through selecting **Agri-Water**.

- **Profile**: Selecting **Profile** from the main menu displays a short textual description of a country, region or river basin if the information is available. The profile text can also be accessed by clicking on **Profile** in the left list

- **Agri-Water:** This option will lead to a page on general description about agricultural water management and list of options for data query. It also provides other options which take when selected to definition of terms used and methodology (blue text) used in estimating agricultural water:

    - **Definition**
    - **Methodology**

- **Maps**: This option provides lists of related maps

Options on the left

a) Agricultural Water

The options under this heading will lead to querying outputs.

- **Irrigation**
- **Cropping pattern**

- **Livestock**
- **Soil and water conservation**
- **Profile**

These will be explained in detail in Section 6.

b) Contact Information

- **Related Links**: The links of some relevant organizations are included to enable direct lining with these stakeholders. Click **Related links** and select the required website of the organization from the list. To return to AWMISET, just click back arrow on the top left corner of any linked website repeatedly until AWMISET Web Page is displayed.

- **Comments**: Clicking **Comments** takes one to a blank page where the user will complete the format with the correct personal information and write comments. When this is done, click **Send** to the send the comments to the web administrator or click **Reset** to ignore sending the comments and return to Home Page. **It is strongly advised that only constructive comments be sent in order not to abuse administrator's time.**

- **Contacts**: Clicking on **Contacts** will open a format for sending an e-mail message to contact person (s) relevant to the database whose e-mail addresses is (are) will be displayed in the To box.

Note: Every page has LOGO but for the purpose of limiting file size, it is displayed only in Home Page.

Agricultural Water Managment Information System of ETHIOPIA

AWMISET

Accurate information is a key for making appropriate decisions

Home | Why AWMISET? | Profiles | Agri-Water | Maps

Contact Info

Related Links
Comments
Contacts

Agricultural Water

Irrigation
Livestock
Cropping Pattern
Soil and Water Conservation
Profile

WELCOME

AWMISET (Agricultural Water Management Information System of ETHIOPIA) which is developed by the support of FAO is Ethiopia's National Information System on irrigated agriculture. The website gives information at national, basin levels and regional.

It keeps records and gives information related to agricultural water management with the following functions:

- providing information including geographical information for the registered irrigation schemes, water harvesting, soil conservational livestock data related to water
- Enabling online data entering and updating the database
- Making easy the data processing and data retrieval from the database

The website will provided the following when complete information is made available.

- Irrigations and typologies disaggregated at national government and basin levels
- Agricultural water use at national and basin levels
- Some socio-economic and environmental aspects of irrigation schemes
- Area treated with soil and water conservation measures
- Cropping pattern
- River Basin, Country or Regional Profiles
- Map

The objective of the website is to inform and help everyone involved in related development programmes search to get up-to-date information on irrigated agriculture (Agricultural water use and other water management information)

Use Our Contacts to send us instant message

The data included in the Database limited to pilot baseline survey in upper Awash Basin and some secondary data compiled by International Water Management Institute (IWMI). Therefore, the aggregate outputs of the Database do not show the complete picture of the Country/ River Basins/ Regions.

ONLY FOR REGISTERED USERS

User Name :		
Password :		
	Log In	Cancel

Figure 1: Home Page

Contact Info

Related Links
Comments
Contacts

Agricultural Water

Irrigation
Livestock
Cropping Pattern
Soil and Water Conservation
Profile

Why AWMISET?

Water is an important ingredient in sustaining and increasing agricultural productivity. Even though Ethiopia is called a water tower country, the recurrent droughts coupled with erratic water supplies in Ethiopia have served as a reminder that water is a limited resource which must not be taken for granted. The threat of climate change augments the need to make the production systems resilient to the risks which a changing climate brings about. Understanding the sensitivities of Ethiopia's water resource system to changing climate patterns is an important step towards increasing risk resilience of agricultural production systems.

Water is beneficial for human beings and ecological abundance only if it is managed in an integrated and sustainable manner, disregarding a fragmented management for short-term needs. In times of growing water scarcity, a uniform and consistent system needs to be created to monitor the impacts of water-related initiatives. It is also important that political and strategic decisions on water resources be based on accurate data regarding water availability, demand and actual use. This requires regular monitoring of the advancements in water resources management. In order to meet the needs of water demand while maintaining the sustainability of aquatic ecosystems, a sustainable framework for water allocation in all river basins of the country is essential.

Irrigation development in Ethiopia dates back centuries while the construction of modern irrigation schemes was started in the 1950s. Thousands of irrigation schemes have been developed, although insignificant compared with the irrigation potential. However, many of the developed irrigation schemes are not operating to their full potential while some others are not functional at all due to factors related to hardware and software problems as well as shortage of water. In Ethiopia, agriculture is estimated to account for more than 90 percent of all water withdrawals, which makes accurate data on agricultural water withdrawals a crucial prerequisite for water resources management. However, accurate and up-to-date information on irrigation is not available. The irrigated area under different water management practices, the amount of water abstracted for crop production, contribution of irrigation for national economy, investment in irrigated agriculture and other related aspects are not known. Moreover, uncontrolled water abstraction for irrigation is common and this does not only cause mismanagement of the scarce water resources but also leads to uncontrollable environmental problem.

The ever increasing use of water for irrigation puts a great pressure on the local hydrology and ecosystem. Competition for water is becoming critical, and environmental degradation related to water use becoming serious mainly due to poor irrigation water management. Hence, while the sustainability of irrigation schemes is becoming a concern, the challenge is to increase simultaneously land and water productivity on sustainable manner in the face of the limited availability of land and water.

The prerequisite for the sustainable water resources development is the knowledge and the availability of water related information and data stored in friendly database system that is easily accessible by the public for development activities. It is on this basis that this FAO-supported Agricultural Water Management Information System (AWMISET) funded by the Italian Development Cooperation was initiated and developed. It is mandatory that this agricultural water use data should be integrated with other sectoral water uses and available water resources in order to enable comprehensive water balance study and make appropriate water allocations for different purposes.

Figure 2: Background of AWMISET

Contact Info

Related Links
Comments
Contacts

Agricultural Water

Irrigation
Livestock
Cropping Pattern
Soil and Water
Conservation
Profile

Agricultural Water Use

Assessment of freshwater and water use is becoming an increasingly important with regard to the growing pressure on this scarce resource. The fresh water resources of Ethiopia have been estimated by several river basin master plan and other specific studies. However, apart from estimating irrigation water requirements from climatic and agronomic data no study has been carried out to assess actual irrigation water use. Assessing the impact of irrigation on water resources requires an estimate of the water effectively used for irrigation, i.e. the volume of water extracted from rivers, lakes and aquifers for irrigation purposes. Irrigation water withdrawal normally far exceeds the consumptive use of irrigation because water is lost in its distribution from its source to the crops.

Except estimation of water abstraction in some large scale irrigation schemes, water withdrawal for irrigation remains unknown because flow measuring structures or devices are not incorporated in most irrigation systems particularly in those owned and managed by communities. For this reason, how much water is abstracted at the diversion point and what portion of the abstracted water is effectively used for crop production is not known. In the absence of this vital information, it is difficult to properly plan water resources development programmes and projects and improve water use efficiency.

On the other hand, there is a need to have at least a crude estimate of annual agricultural water withdrawal to enable making comparison with the available renewable water resources. Assessing the impact of irrigation on water resources, the potential for future development and the overall impact of human activities on the water cycle requires an approach by river basin. Cognizance to the reality of lacking water measuring facilities, annual agricultural water withdrawal at country, river basin or lower level needs to be estimated using the methodology outlined below

Definitions
Methodology

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Figure 3: Agri-Water page

Contact Info
Related Links
Comments
Contacts

Agricultural Water
Irrigation
Livestock
Cropping Pattern
Soil and Water Conservation
Profile

Methodology for Estimating Net Irrigation Water Requirements

In situation where water use is not measured we need to estimate irrigation water requirements from climatic data and crop properties although the estimates usually deviates from actual water use due to any or combination of the following

- excess or shortage of water supply
- failure of irrigation infrastructure limiting irrigation supply
- high rainfall used in estimating effective rainfall

The methodology for estimating irrigation water requirement combines information cropping patterns, crop coefficients and climate data (rainfall and evapotranspiration). Net irrigation water requirements were computed based on the following formula:
IWRn (m) = 10 * max(0 , ((Kc(m) × ETo(m)) - **ETa(m)**)) –St) * A * CI(m)

Where:

IWRn	=	Net Irrigation water requirements to cover crop evapotranspiration
Kc	=	Crop coefficient
ETo	=	Reference evapotranspiration per month (mm)
ETa	=	**Actual evapotranspiration (mm)**
A	=	Actual irrigated physical area (ha)
St	=	The change in soil moisture from previous month (assumed to be zero)
CI	=	Cropping intensity
m	=	Monthly time step of the calculation

Estimation of ETa requires conducting water balance study for a river basin using soil-water balance model for which time series hydrological and meteorological data and soils data as well as geo-referenced spatial data are needed. Because these data are lacking, it is resorted to use effective rainfall. The effective rainfall is part of the total amount of rainfall used to satisfy crop water need and it is influenced by climate, soil texture and structure, depth of rootzone, topography, initial soil moisture conditions. Hence, irrigation water requirements are estimated using the following crop water balance

FAO: CROPWAT

IWRn = 10*Max(0 , (Kc (m)× ETo (m)) –Pe(m))*A*CI (m)
Pe = 0.6P-10 for P<=70 and Pe= 0.8P-24 for P>70

Where P=monthly rainfall in mm

Net irrigation water requirements were estimated for each irrigation scheme based on actual cropping patterns collected in the baseline survey and summed for the river basin or country. The national irrigation water requirement is simply the aggregate of the basin level irrigation water requirements.
Gross irrigation water requirement is then obtained through the following equation:

IWRg = IWRn / E

Where IWRg = gross irrigation water requirement
E = irrigation efficiency for a given type of irrigation system

Considering the prevalence of water shortage in the surveyed irrigation schemes, an overall irrigation efficiency of 60% was applied to estimate.

Methodology for Estimating Livestock Water Use

Water use per livestock head varies with type of animal, climates and animal-husbandry practices. Therefore it is best to collect information on types and number of animals at river basin or sub-levels or at administrative setup level taking into consideration any level of hydrologic unit. The ranges of daily water requirements of animals are listed below. These rates should be refined for different agro-ecology as water consumption varies from one agro-ecology to another.

Type of Animal	Water Consumption Rate per head (lit/day)	Average rate adopted for the calculation (lit/day)
Cattle	25-35	30
Sheep & goats	4-5	4.5
Equine	20-25	22.5
Camel	50-70	60
Hens	0.15-0.25	0.2

NB. Equine includes horse, mule and donkey.

Livestock water use can be estimated using the following formula
Livestock Water Demand = Duration x Consumption rate x Number of livestock
Total annual livestock water use can be estimated by the formula

$$LWU = 0.365 \sum_{i=1}^{N} CiL$$

Where,
LWU=Total livestock water use (m3)
Ci=Daily water consumption rate of water by type of livestock (liters)
Li=Number of livestock by type

<Back
Definitions

Figure 4: Methodology Page

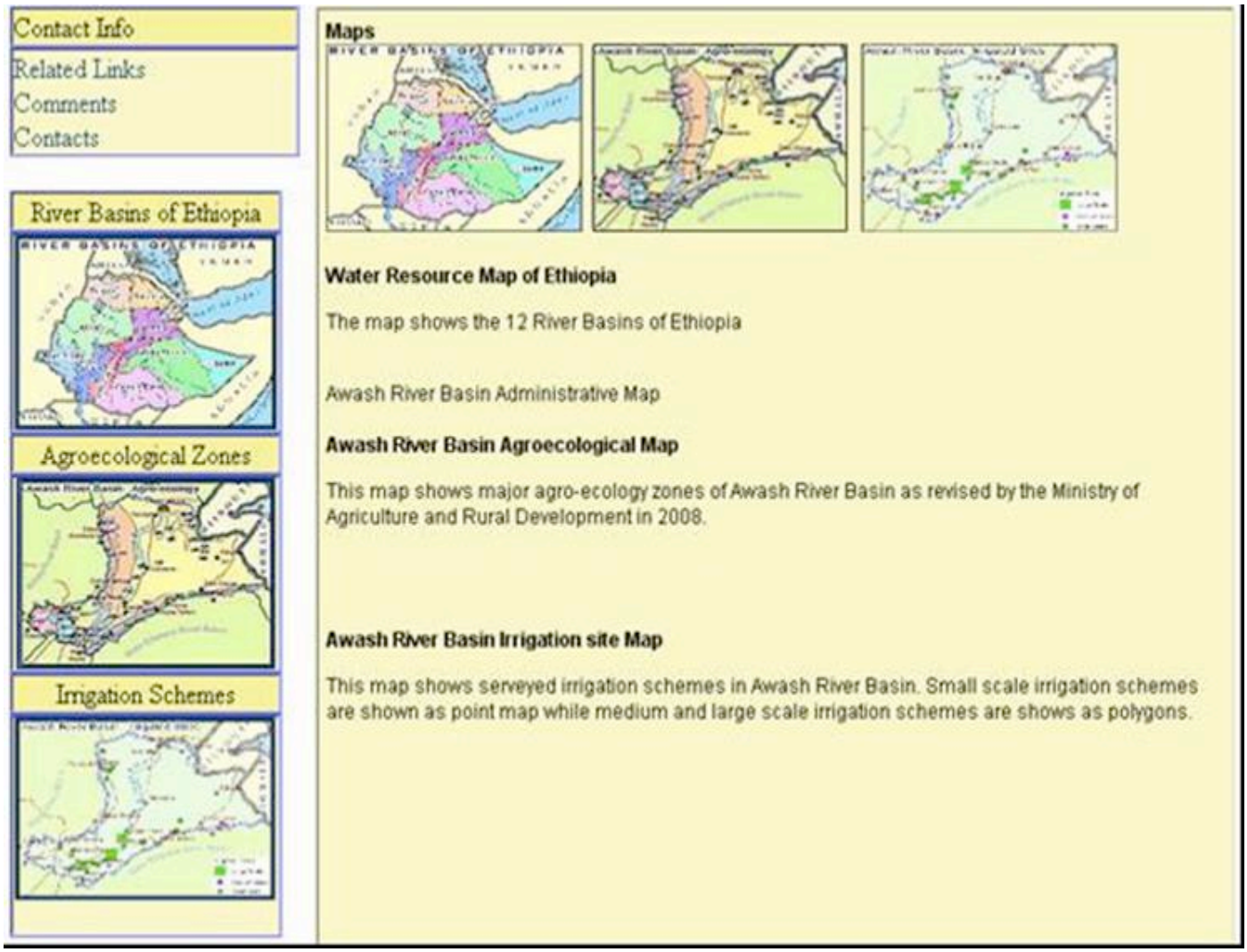

Figure 5: Map Display Page

2.3 Starting and Exiting AWMISET

AWMISET is accessed through the website of the Ministry of Water Resources (MoWR). The website of the MoWR is **http://www.mowr.gov.et**. Hence, a user can first open the MoWR website and select **AWMISET** (Agricultural Water Management) from the listed options below **Search** on the left. This will activate the **AWMISET Home Page**. The required information will then be accessed by just selecting the title from the main menu of the **Home Page**.

To exit AWMISET, just click the close button at the top right corner of any page.

2.4 Routes through the Program

The main route through the program follows the menu options on the top of the screen. These options will lead to displaying of information that can be accessed through sub-menus and criteria. For example, the option "**Agri-Water**" (agricultural water) will lead to querying outputs that can be accessed by selecting from the list on the left of the page. The list is also available on the **Home Page**.

The required option or information to be accessed is selected from the list on the left in the Home or Agri-Water Page. This will lead to a page as shown in Figure 6 from which criteria for the required information are selected. As shown in the figure, the two major criteria are:

- Year for which information is required
- Location (country, region or river basin)

2.5 Contact Info

Figures 6-7 show the pages of **Related Links and Comments respectively**. Clicking Contacts will open mailing dialogue box (outlook, yahoo, or any other depending on default setting of a particular computer).

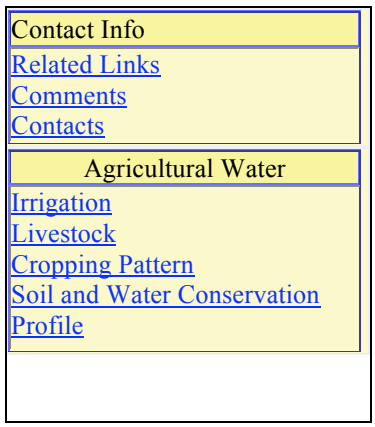

Figure 6: A Page showing Links to relevant Organizations

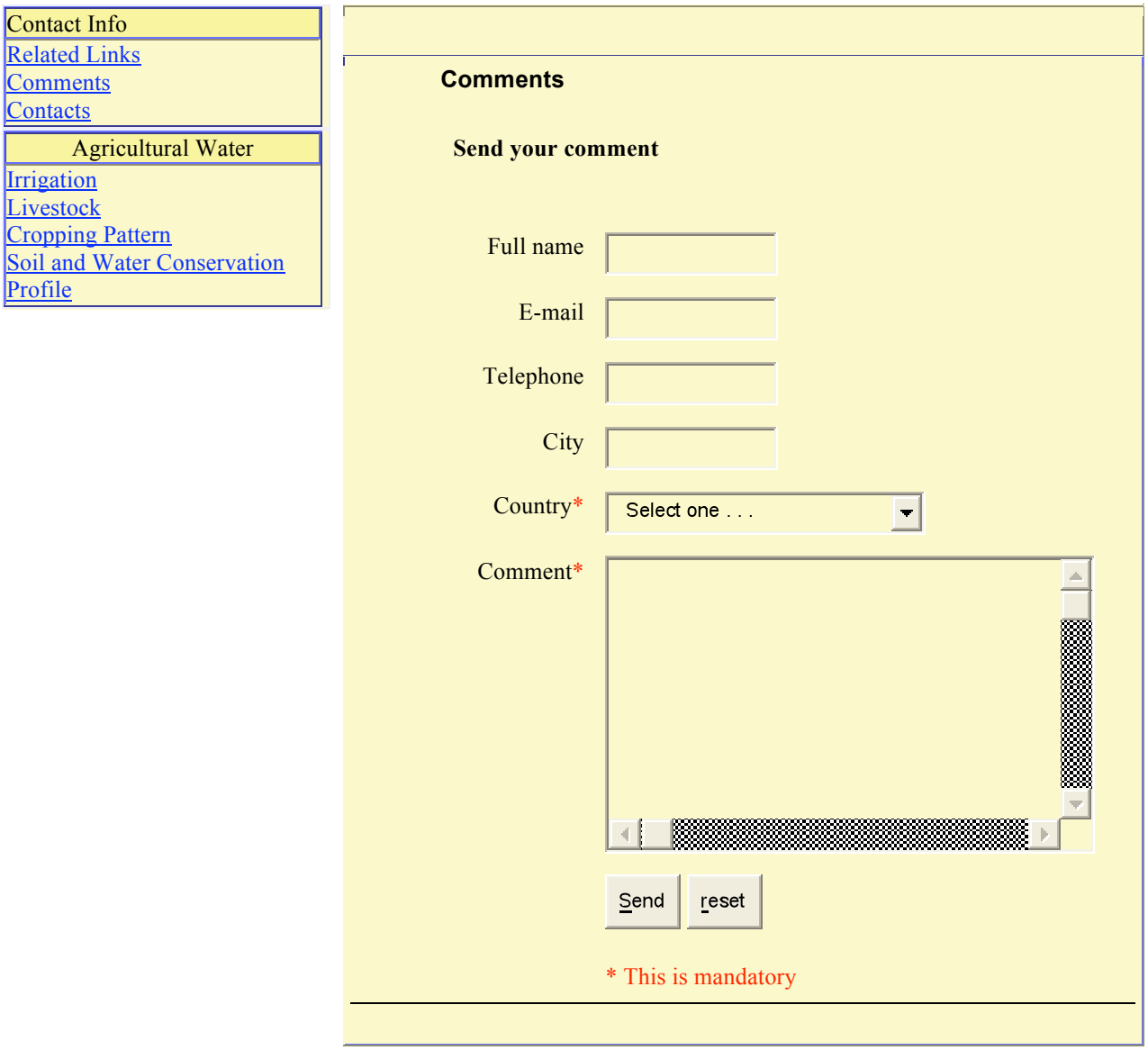

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Figure 7: Comment Page.

2.6 User Administration

The web administrator provides user name and passwords to the regions and other relevant organizations that are authorized to be registered. To do this the web administrator will log in using own login user name and password. The web administrator pages are shown in Figures 8 and 9 below.

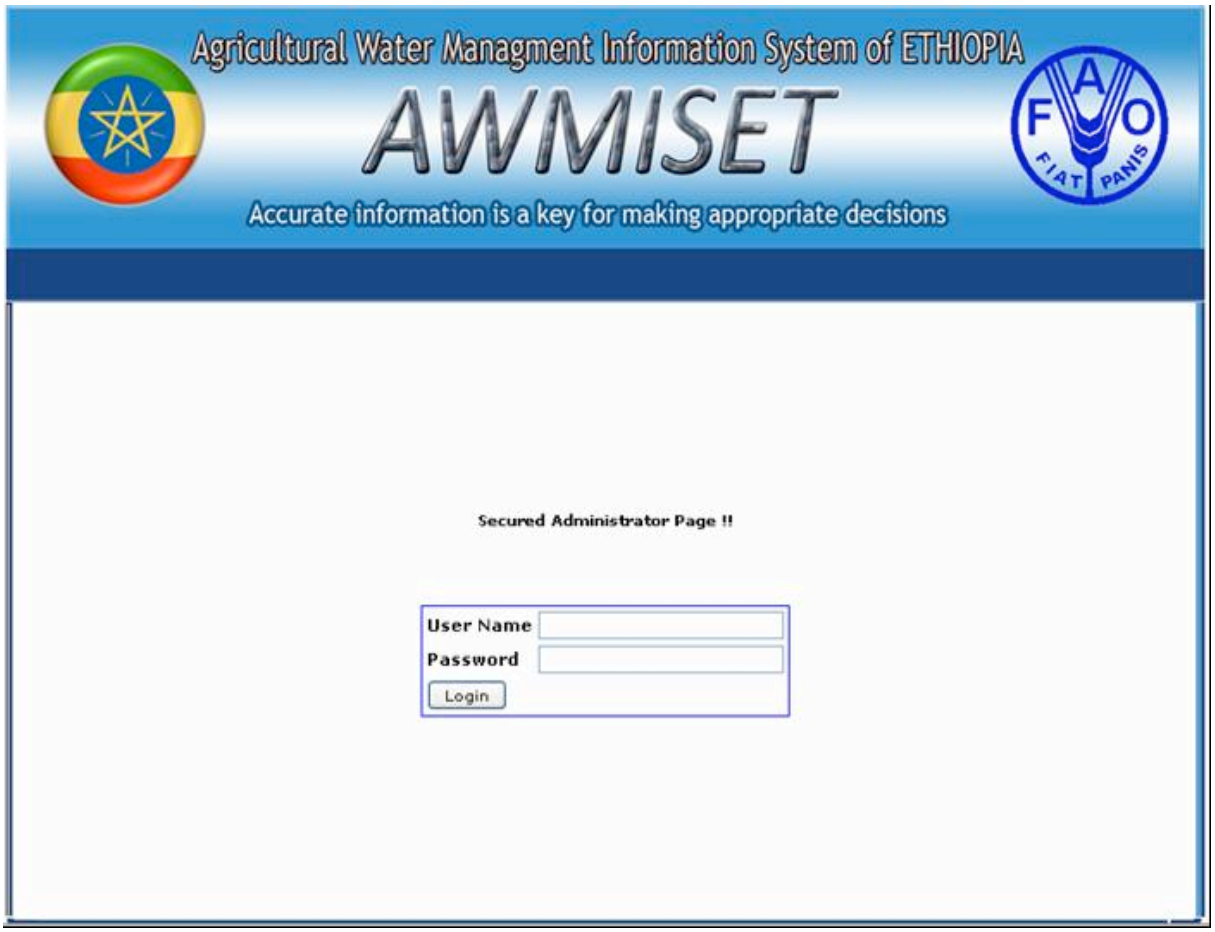


Figure 8: Web Master Page

Manage Users Links

Add New User
Edit User
Delete And Show Users
Comment list

Click here to Export Raw Data

Add New User

User Name*
Password*
First Name*
Last Name*
Region* Select one . . .
Email
Sex Male Female
Job Location
Job Title
Zone
Kebele
Woreda
Telephone
Register Date
Last Visit Date

* Mandatory

Add reset

Figure 9: User Registration page

3. DATA ENTRY

3.1 Irrigation Scheme

3.1.1 Irrigation related data

Entering irrigation data one has to activate the Data entry pages by logging in with **User Name** and **Password** at the bottom of the **Home Page in Figure 1 above**. The **Irrigation Data Entry Page** is shown in Figure 10 below. The user then will fill all the blank spaces either by typing or selecting from the drawdown menus as appropriate. Names should be started with capital letters. Abbreviations and dots should be avoided.

When entering data of one irrigation scheme is finished, click **Insert** to record the data and pass to the next page. If the information entered is correct a message "**The data is successfully recorded.**" will be displayed at the top and this will be followed by **Socioeconomics Data Entry Page** if the irrigation scheme is community-owned, otherwise **Location Data Entry Page** will be displayed. As Primary key of this irrigation page is name of irrigation scheme, entering the name of the irrigation scheme is mandatory.

Some of the data to be recorded are mandatory. Such data are marked with red asterisk (*). Hence, the data marked with red asterisk must be filled otherwise the system does not accept the insertion or recording of the other information.

If the data entered is wrong which is detected by validation rules, a message will be displayed to indicate the wrongness of the data and the same page showing all the typed data (the information selected from the drawdown menus will be lost) will remain displayed. For example, if actual irrigated is more than the area equipped for irrigation, or if harvested area is more than the area actually irrigated, the following a message will be displayed.

"**Actual irrigated area EXCEEDS equipped area or harvested area EXCEEDS actually irrigated area** "

If any of the abandoned, waterlogged, eroded or flooded areas or their sum is more than equipped area, relevant message will be displayed. The validation rule applies to these and other quantitative data. The problem is in textual information for which validation rule cannot be included. **Therefore, care has to be taken to check the correctness of all the information before entering them.**

The units of all the data are also indicated within parenthesis of each variable. Areas are in hectare (ha) while actual water use, estimated and water abstractions irrigation water requirements, are given in thousands cubic meters ('000m3). That means the figure should be divided by 1000 before entering the data on these.

Any entered data can be cancelled by clicking on **Reset** button before clicking on Insert.

Contact Info

Related Links
Comments
Contacts

Data Entry Links

Irrigation Scheme
Water Harvesting
Soil and Water Conservation
Livestock
Cropping Pattern

Edit

You are logged on as sa

Log out

Irrigation Scheme

Click here to Export Raw Data

Name of Scheme*	
Water source	Select one . . .
Name of Water source	
Water Abstraction	Select one . . .
Irrigation System	Select one . . .
Irrigation Typology	Select one . . .
Urban/Rural	Select one . . .
Equipped Area(Ae)*	ha
Actual Irrigated Area(Ai)*	ha
Reason for Ai < Ae	Select one . . .
Harvested Area	ha
Drained Area (irrigated)	ha
Actual Water Withdrawal	('000m3)
Estimated Water Abstraction	('000m3)
Estimated IWR	('000m3)

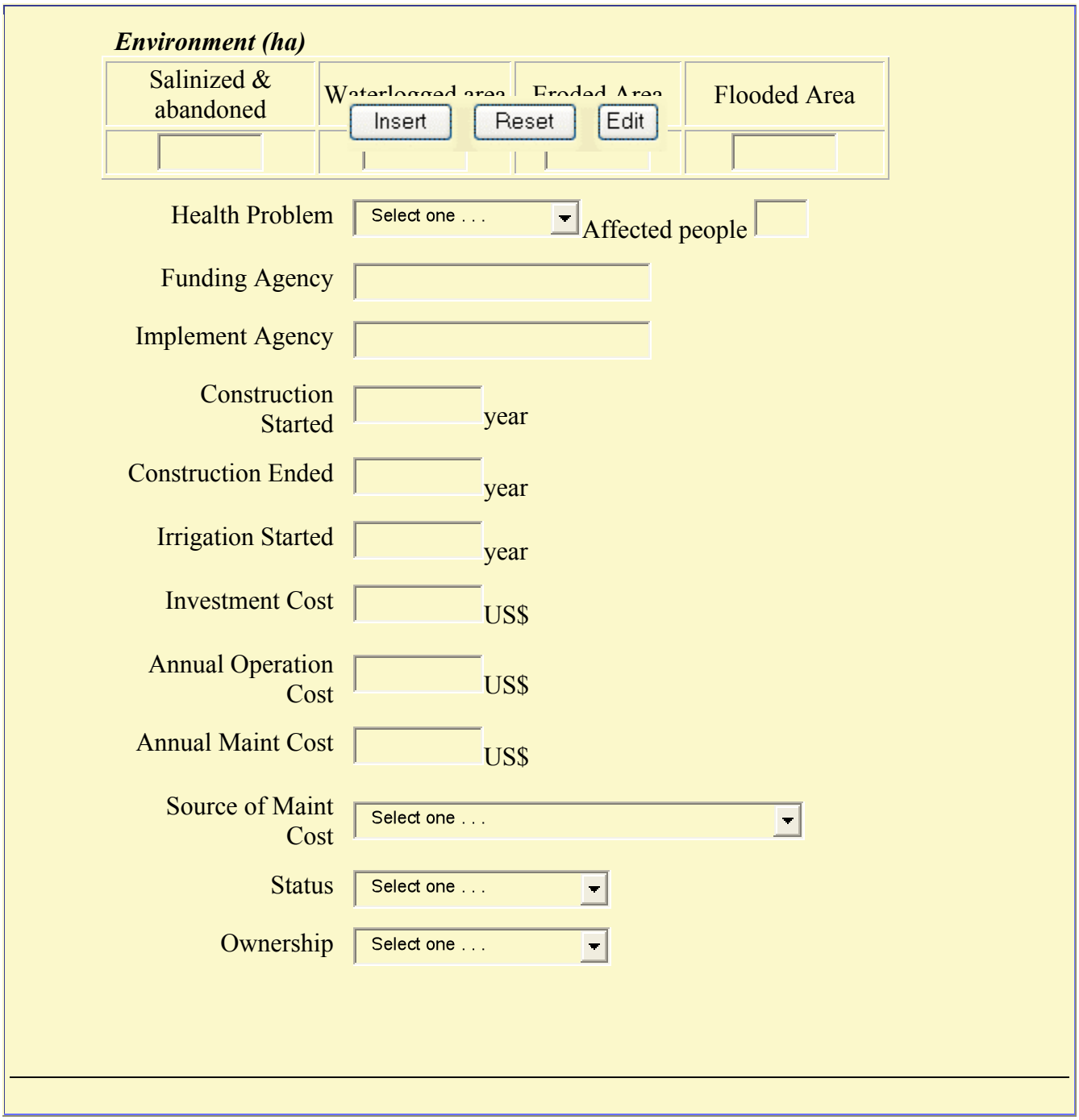


Figure 10: Irrigation data Entry Page

3.1.2 Socioeconomics

If the irrigation scheme is community-owned and the data is successfully recorded, **Socioeconomics Data Entry Page** will be activated (Figure 11). Validation rule is included in here to check data correctness. Hence, if any of the number of male or female beneficiaries or their sum or the number of association members (if any) is more than the total actual beneficiaries, a message will be displayed indicating the need to correct the data. Recording data will be will be completed by clicking the **Insert** button which also activated location page.

Similar to irrigation page, primary key for this page is the actual beneficiaries and this box must be filled in order to successfully complete data entry and continue with location data. It is always true that number of actual beneficiaries is available. Non-availability of such information indicates inadequate monitoring and an irrigation scheme with missing such important data should neo be recorded in the database. If the number of male and female beneficiaries is more than the actual beneficiaries, a message will be displayed to enter the correct data.

Contact Info

Related Links
Comments
Contacts

Insert Reset Edit

Edit

You are logged on as ----- **Welcome**

Irrigation Site

Socioeconomics - Irrigation scheme

Initial/Planned beneficiaries [ ] hh

Actual beneficiaries* [ ] hh

Male beneficiaries [ ] hh

Female beneficiaries [ ] hh

Beneficiaries' organization [Select one . . .]

Name of Organization [ ]

No of organization members [ ]

No of Male Exec member [ ]

No of Female Exec member [ ]

Priority of access to water [Select one . . .]

Basis of water charge [Select one . . .]

* Mandatory

Figure 11: Socioeconomics Data Entry page

3.1.3 Location

Once the irrigation data is successful recorded the **Location Data Entry Page** as shown in Figure 12 will be displayed. The required information should similarly be filled in the appropriate places. Similar to irrigation data, textual information should start with capital letter.

Geographical coordinates or latitudes (northing) and longitudes (easting) could be reported in different units such as Degree, Minute and Seconds (**DDMMSS),** Degree and Minute (**DDMM)** or **(Degree DD)**. Hence, the data to be entered set to be in one format: **Degree with a maximum of four decimal places** (**DD.DDDD**). Although the questionnaire clearly indicates that coordinates should be reported in this format, there can be cases where these may be reported in different forms as observed in the Pilot Survey. Therefore, the coordinates reported in different format should be first converted to **DD.DDDD** before entering.

Coordinates reported in other than degree (**DD.DDDD)** can be covered to degree (decimal) as follows:

a) Coordinates reported in DDMMSS

   DD.DDDD = DD+ MM/60 + SS/3600

b) Coordinates reported in DDMM

   DD.DDDD = DD+ MM/60

c) Coordinates reported in Universal Transverse Mercator (UTM) requires GIS expertise for its conversion to degree.

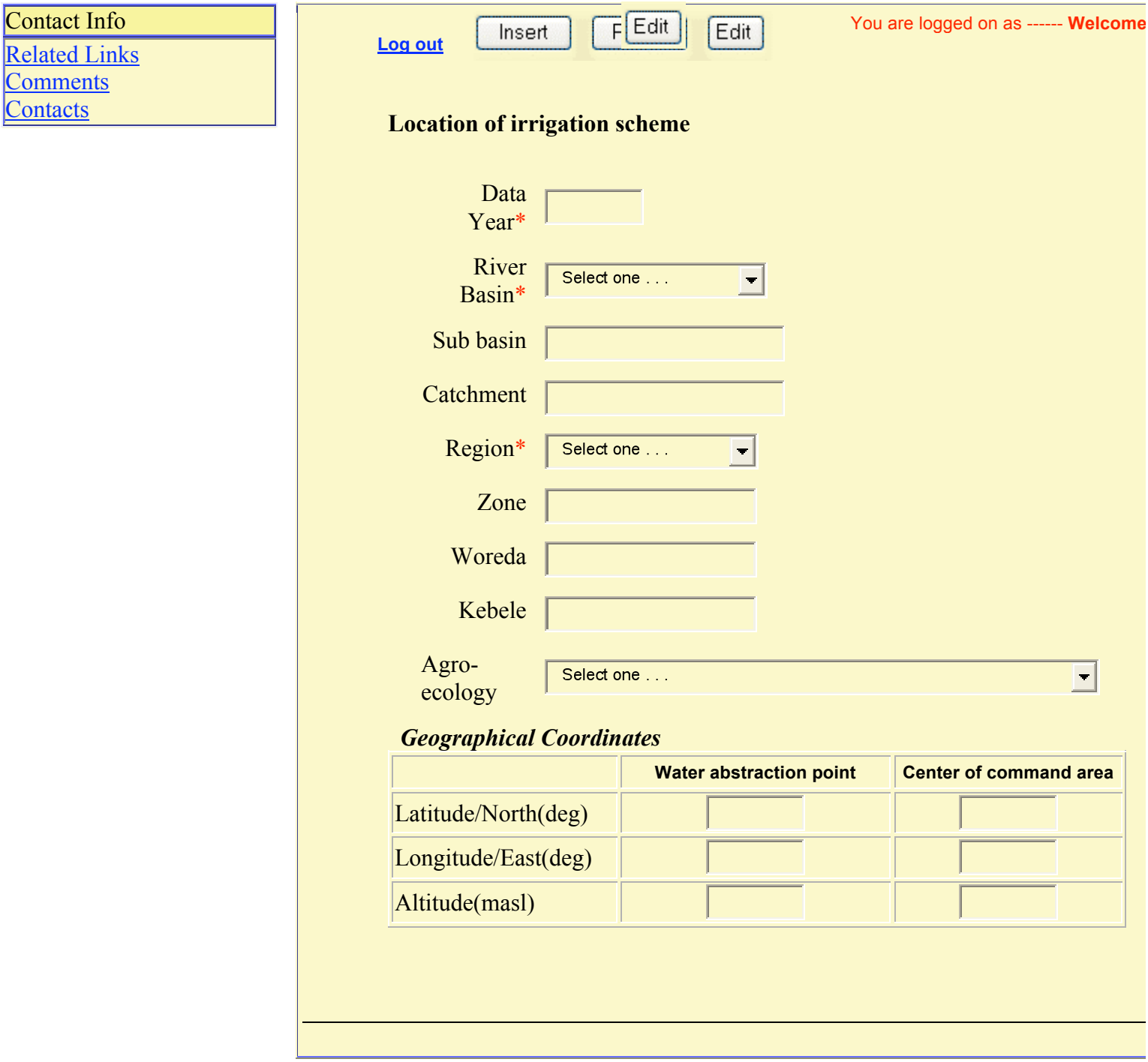


Figure 12: Location Data Entry Page

3. 2 Water Harvesting, Livestock and Soil conservation Data

Water sector monitoring should be carried out at river basin, sub-basin or catchment levels. However, considering the prevailing situation where reporting mechanism is through administrative setup and due to inadequate capacity of the woredas to complete a questionnaire for each site particularly for water harvesting and soil conservation activities, it is suggested that the woredas aggregate the

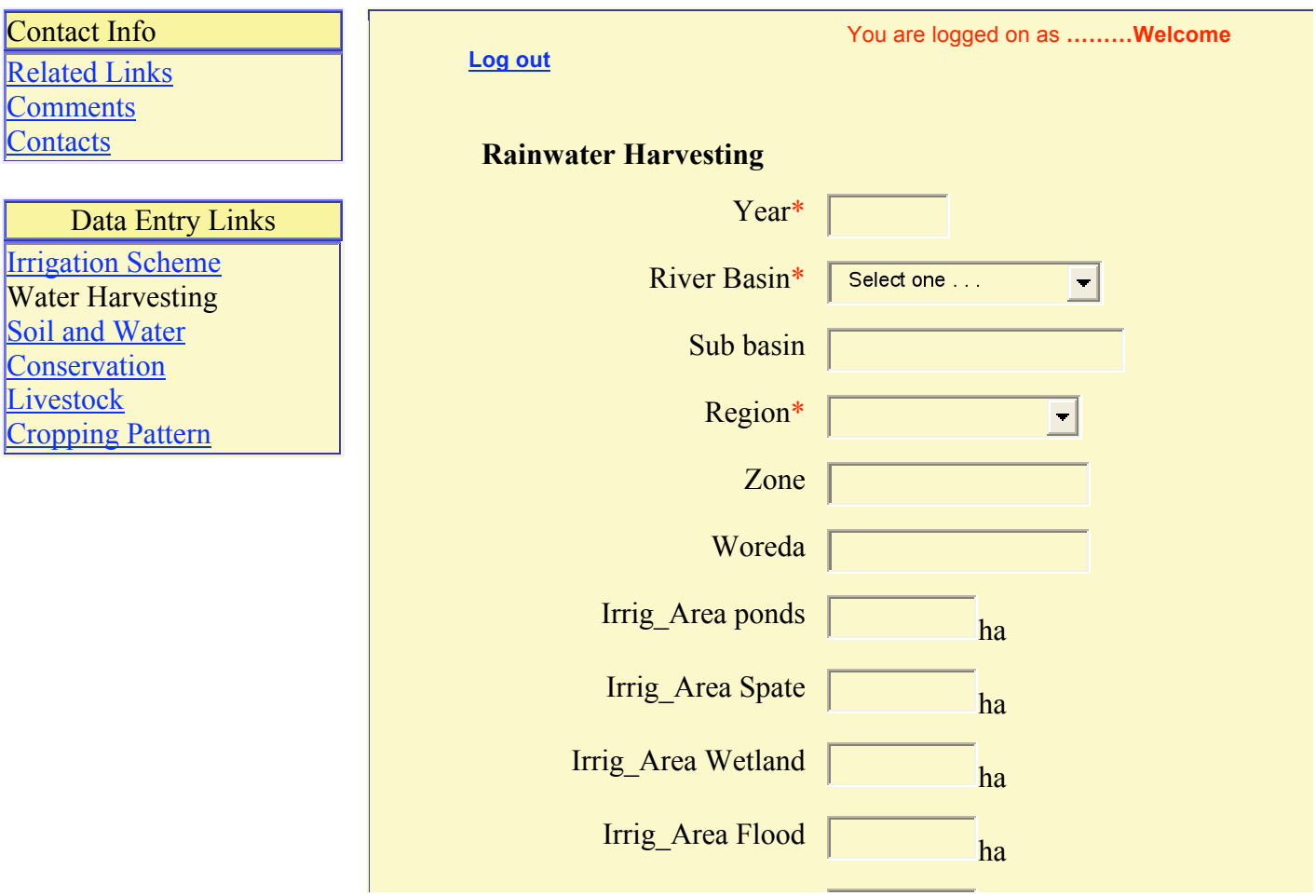
information related to water harvesting, soil and water conservation and livestock by basin, sub-basin or catchment. That means, if a woreda falls in two or more basins, the woreda should aggregate the data by river basin and this requires the woreda to fill two or more questionnaires depending on the number of river basin the woreda falls in.

3.2.1 Rain Water Harvesting

The Data Entry Page is directly accessed from the list on the left under the **Data Entry Links**. Clicking **Water Harvesting** will activate the page as shown in Figure 13 below.

The data on irrigated area are woreda aggregates. In the list of irrigation technology (pond, spate, flood and wetland, "**Others**" will also include pump irrigation at individual or household level where the individual areas are less than 2.5 ha.

The total area entered is also categorized under three irrigation systems: **Surface, Sprinkler** and **Drip/localized** as well as water abstraction methods: **Gravity** and **Pump**. Hence, validation rules are included to check whether the sum of areas under the three irrigation systems is equal to the total area under the two water abstraction methods as well as the sum of the areas under different typologies listed above. If there is deviation, a message indicating the incorrectness of the data will be displayed.



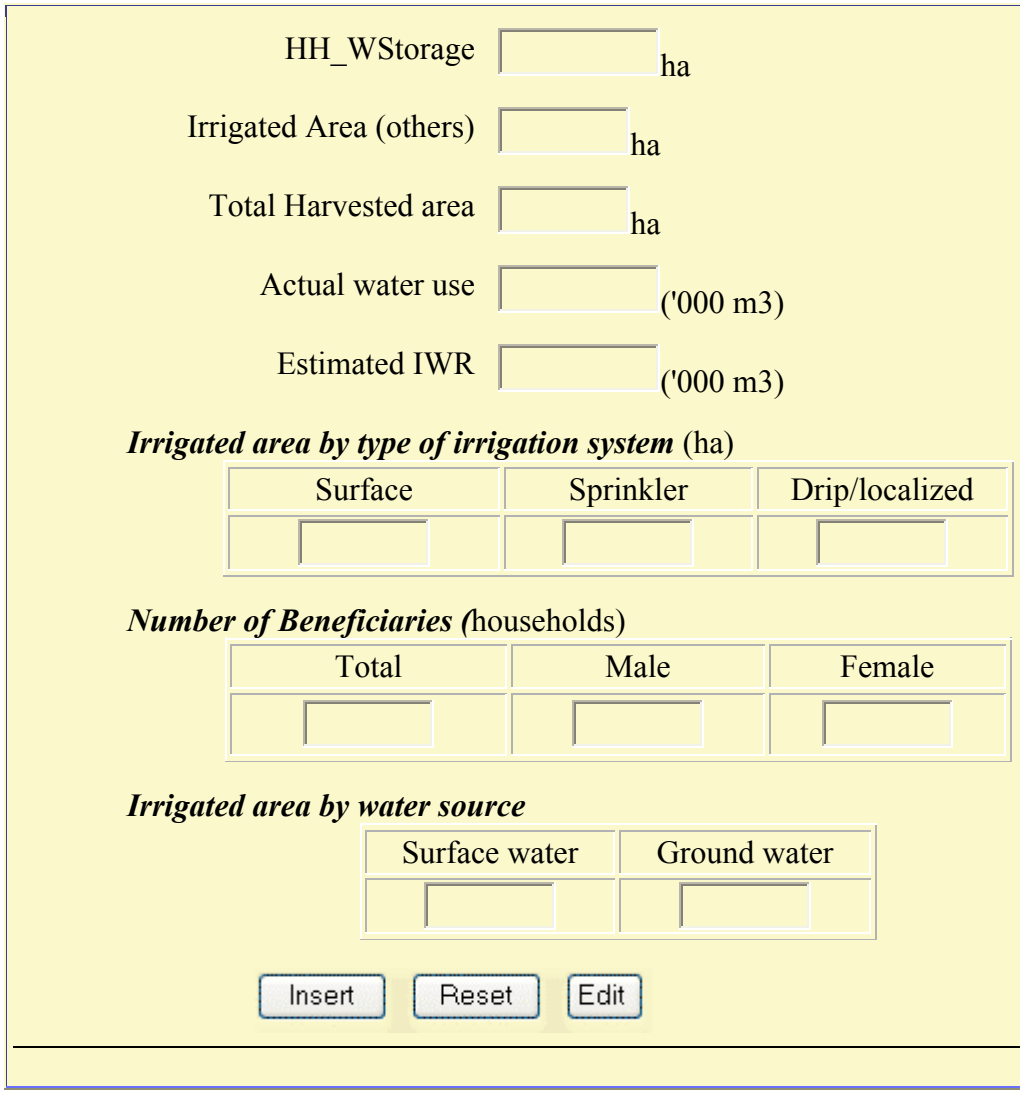


Figure 13: Water Harvesting Data Entry page

3.2.2 Livestock

3.2.3 Water Use

The, **Livestock Data Entry Page** can be directly accessed from the **Data Entry Links**. The page looks like in Figure 14.

The monitoring format considers only number of livestock by type of category and data aggregated by woreda taking into account the river basins within which the woreda falls will be reported. The data should be entered in the livestock data entry page (Figure 9) separately for each basin. Because daily water consumption rates of donkeys, horses and mules is the same, they are grouped under equines and their sum should be entered in the database.

Contact Info

Related Links
Comments
Contacts

Agriculture Water

Irrigation Scheme
Water Harvesting
Soil and Water
Conservation
Livestock
Cropping Pattern

Insert Reset Edit

You are logged on as ------- **Welcome**

Log out

Livestock population

Year*

Region*

Zone

Woreda

River Basin* Select one . . .

Sub basin

Cattle

Equines

Camel

Sheep

Goat

Poultry

Year*

Figure 14: Livestock Data Entry page

3. 2.3 Soil and Water Conservation

The data entry page for areas treated by different soil and water conservation measures will be directly accessed by selecting the **Soil and Water Conservation** under the **Data Entry Link** in the Home page. When **Soil and Water Conservation** is selected, data entry format shown in the Figure 15 is displayed. Four of the data are related to soil and water conservation while one is on drainage of non-irrigated lands. The relevant quantitative information can be entered in the format for each river basin. As there is no validation for all these records, care has to be taken in entering the right quantitative data.

Contact Info

Related Links
Comments
Contacts

Data Entry Links

Irrigation Scheme
Water Harvesting
Soil and Water Conservation
Livestock
Cropping Pattern

Insert Edit Edit

You are logged on.....Welcom

Log out

Area treated with Soil and water conservation

Year*

Region*

Woreda

River Basin* Select one . . .

Sub basin

Catchment

Catchment Area ha

Area - physical measures ha

Area - biological measures ha

Area - biophysical measures ha

Area closure ha

Drainage of non-irrigated lands

Drained area (non irrigated) ha

Figure 15: Data Entry page for area treated with soil conservation measures

3.5 Data on Cropping Pattern

Data on cropping pattern includes location and area related information in order to enable one to enter complete data in this page without referring the other pages. The format for entering cropping pattern is shown in Figure 16. Data entry is either by typing names and quantitative information while others can be selected from dropdown menus. **In this case care should be taken to ensure that the names of the irrigation schemes are spelled correctly.**

Crop type and planting and harvesting months will be selected from the dropdown menu while area covered by each crop and production data will be typed. As incorporation of validation rule that checks whether the total actually irrigated area is equal or more than the sum of the areas covered by all crops in a particular month, necessary precaution has to be taken to make sure that monthly planted areas should not exceed the actually irrigated area.

Contact Info

Related Links
Comments
Contacts

Data Entry Links

Irrigation Scheme
Water Harvesting
Soil and Water
Conservation
Livestock
Cropping Pattern

Log out

You Insert Reset Edit it

Fill Cropping pattern information

Year*

Name of scheme*

Region*

River Basin* Select one . . .

Sub basin

Agro-ecology Select one . . .

Equipped area (ha)

Actual irrigated area (ha)

Harvested area (ha)

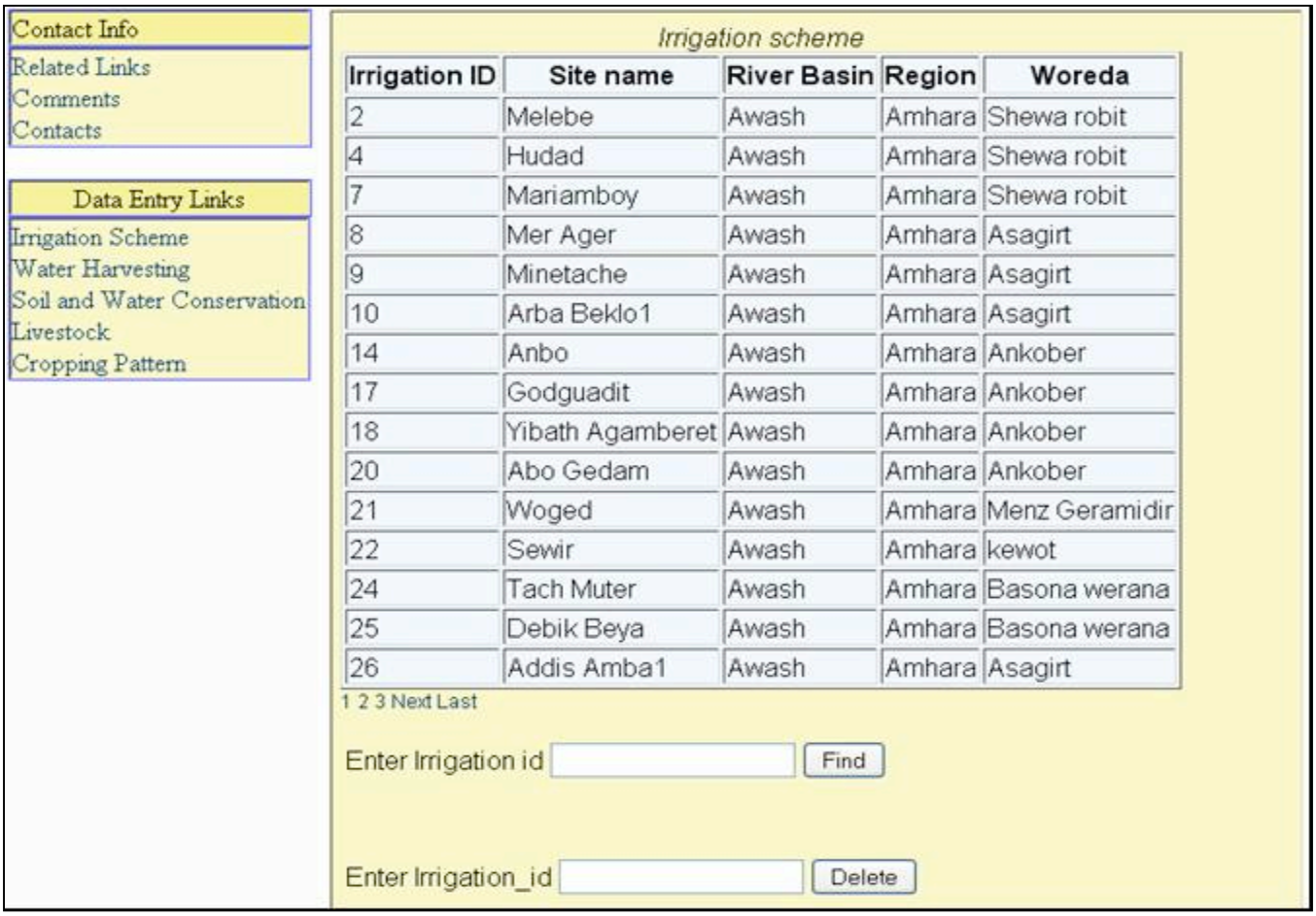
Crop Type	Planting Month	Harvesting Month	Planted Area(ha)	Produ (qt
Select one . . .	Select one . . .	Select one . . .		
Select one . . .	Select one . . .	Select one . . .		
Select one . . .	Select one . . .	Select one . . .		
Select one . . .	Select one . . .	Select one . . .		

Figure 16: Cropping Pattern Data Entry page

4. EDITING AND DELETING DATA

There is a possibility of entering wrong data for which neither validation is required nor included. AWMISET has a tool to correct the data but only registered users can edit the data. In all the Data Entry Pages of any, command button labeled "Edit" will be displayed. Clicking this Edit button will activate a page showing the ID number and some recorded data as depicted in Figures 12 and 13 for irrigation and water harvesting pages respectively. Browse through the record to find the wrong data. Enter the ID number of the record with wrong data in the box, next to "Please enter **Xxx_Ro_id**, and click on "**Find**" button (**Xxx** refers to irrigation, water harvesting, soil and water conservation or livestock while Ro-Id refers to record ID number). The Edit pages showing Data Entry Pages with the recorded data will be displayed as shown in Figures 17 and 18 for irrigation and water harvesting pages respectively. While Figures 19-20 show pages for editing soil and water conservation and livestock data.

The same procedure can be followed for deleting a record. That is, insert the ID of the record to be deleted and click on **Delete** button**. A Data Editing Page** asking for confirmation for deleting will be displayed. This can be confirmed by selecting **"Yes" or "Reset".** One should not rush for deleting a record. Think twice before deleting a record.



Irrigation ID	Site name	River Basin	Region	Woreda
2	Melebe	Awash	Amhara	Shewa robit
4	Hudad	Awash	Amhara	Shewa robit
7	Mariamboy	Awash	Amhara	Shewa robit
8	Mer Ager	Awash	Amhara	Asagirt
9	Minetache	Awash	Amhara	Asagirt
10	Arba Beklo1	Awash	Amhara	Asagirt
14	Anbo	Awash	Amhara	Ankober
17	Godguadit	Awash	Amhara	Ankober
18	Yibath Agamberet	Awash	Amhara	Ankober
20	Abo Gedam	Awash	Amhara	Ankober
21	Woged	Awash	Amhara	Menz Geramidir
22	Sewir	Awash	Amhara	kewot
24	Tach Muter	Awash	Amhara	Basona werana
25	Debik Beya	Awash	Amhara	Basona werana
26	Addis Amba1	Awash	Amhara	Asagirt

Figure 17 : Data Editing Page for Irrigation Scheme

Contact Info
Related Links
Comments
Contacts

Data Entry Links
Irrigation Scheme
Water Harvesting
Soil and Water Conservation
Livestock
Cropping Pattern

Improved Water harvesting information

RWH_Ro_id	River Basin	Region	Zone	Woreda	Beneficiaries total
14	Awash	Amhara	North shewa	Menz Gera Midir	194
16	Awash	Amhara	North shewa	Basona werana	130
18	Awash	Amhara	north shewa	Asagirt	19
29	Awash	Amhara	North shewa	Minjar Shenkora	932

1

Enter RWH_Ro_id [ ] Find

Enter RWH_Ro_id [ ] Delete

Figure 18: Data Editing Page for Water Harvesting

Contact Info
Related Links
Comments
Contacts

Data Entry Links
Irrigation Scheme
Water Harvesting
Soil and Water Conservation
Livestock
Cropping Pattern

Soil and Water conservation

So_wc_ro_no	River Basin	Sub_basin	Catchment	Region	Woreda	Area Treated
1	Awash	Ametu	Mer ager	Amhara	Asagirt	2.0
2	Awash	Ametu	Mohamed	Amhara	Asagirt	2.0
3	Awash	Kebena	Ayalfush	Amhara	Ankober	4334.0
4	Awash	Kebena	Keyit	Amhara	Ankober	0.0
5	Awash	Kebena	Godguadit	Amhara	Ankober	0.0
7	Awash	Kebena	Anbo	Amhara	Ankober	0.0
8	Awash		Amash	Amhara	Menz Geramidir	0.0
9	Awash	Chew Bele	Meka	Amhara	Basona Worana	0.0
10	Awash	Chew Bele	Weses	Amhara	Basona Worana	0.0
11	Awash	Gewha	Gewha	Amhara	Menz Mama	0.0
12	Awash	Dibetu River	Gora Akababi	Amhara	Minjar Shenkora	0.0
13	Awash	Kesem	Bidru	Amhara	Minjar Shenkora	90.0
14	Awash	Kesem	Bedesa	Amhara	Minjar Shenkora	145.0

1 2 Next Last

Please enter So_wc_ro_no:- [ ] Find

Please enter So_wc_ro_no:- [ ] Delete

Figure 19: Data editing page for Area Treated with Soil and Water Conservation Measures

Contact Info

Related Links
Comments
Contacts

Data Entry Links

Irrigation Site
Improved RW
Soil and WC
Livestock Entry
Cropping Pattern

Livestock Number

Live_id	Cattle	Equines	Camel	Sheep	Goat	Poultry	Region
1	6870000	1190000	410000	3050000	3640000	6220000	

1

Please enter Live_id:-

Please enter Live_id:-

Figure 20: Data Entry page for Livestock Information

5. QUERYING INFORMATION AND DATA EXPORT

5.1 Query of Information

5.1.1 General

As explained in Section 2, queries for Country, River Basin or Region Profile (text) and maps can be made either from main menu or from the list in the left. For other information, the selection can be made from the list on the left of the **Home** or **Agri-Water Page** as shown in Figure 1 or 3 above. When any of the listed options on the left is selected, the page shown in Figure 21 will be displayed.

Any selection should be confirmed by clicking **Show** button. Clicking on **Reset** button will cancel the selections made.

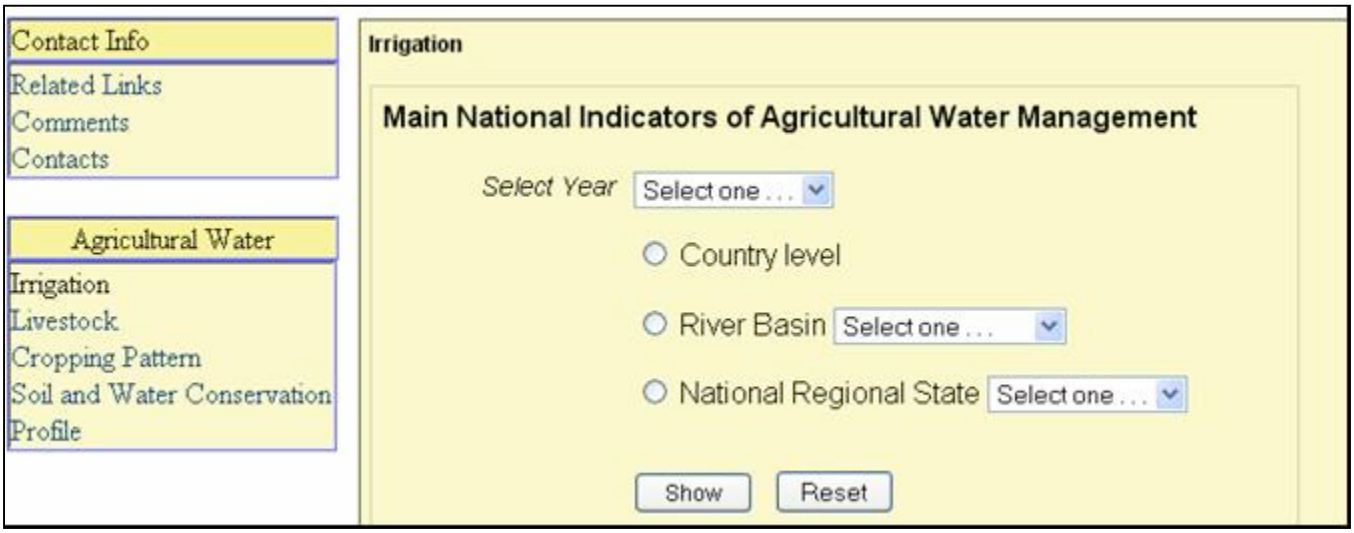


Figure 21: Query Options for Required Information, in this case Irrigation is highlighted

5.1.2 Irrigation

To query irrigation related information, select **Irrigation** from the list in the left of Home or Agri-Water Page. This will activate a page for selecting year and location. Select the Year and location (country, river basin or region) from drawdown menus and click on **Show** button, the Page shown in Figure 22 will be displayed showing the summary of four indicators related to agricultural water management.

One can then continue to query the desired information by selecting any of the options listed below the summary indicators. It is also possible to go from any page to the previous page.

If year or location is not selected, the following message will be displayed.

"Please select year or location".

Selecting a year for which data does not exist will display the following message:

"Record for the selected year or location does not exist in the database"

Selecting any of the options (water withdrawal, irrigated area or socioeconomics) from the list in Figure 22 will activated respective output pages as shown in Figures 23-25

.

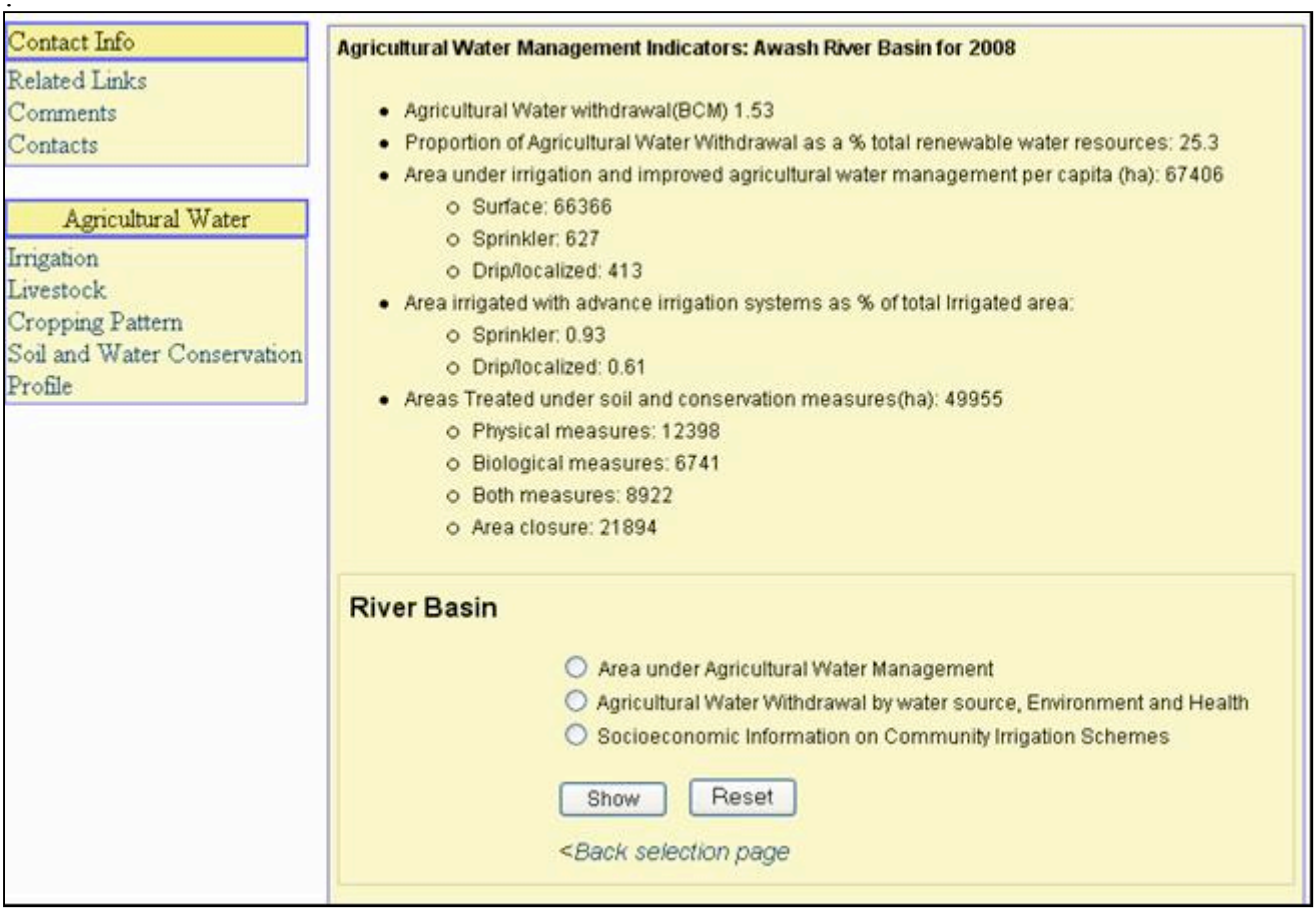


Figure 22: Main Agricultural Related Indicators

Contact Info

Related Links
Comments
Contacts

Agricultural Water

Irrigation
Livestock
Cropping Pattern
Soil and Water
Conservation
Profile

Area under Agricultural Water Management Awash River Basin for Year 2008

Description	Area equipped for irrigation (ha)	Actually Irrigation (ha)	Actually Irrigation as % of equipped area
Irrigation by scale			
Improved RWH	162	162	100
Small scale (up to 200 ha)	13420	12682.8	94.5
Medium scale (200 - 3000 ha)	25114	24823	98.8
Large scale (above 3000 ha)	28710	28710	93.1
Irrigation by Typology			
Traditional Irrigation	24307	23707.8	97.5
Modern Irrigation	42937	40520	94.4
Total area under AWM			
Full Control			
Surface	66294	63278	95.5
Sprinkler	627	627	100
Drip	413	413	100
Partial control			
Area irrigated under equipped wetlands			
Area equipped under spate irrigation			
Area with other forms of agricultural water control			
Area irrigated under non-equipped wetlands	0	0	
Area irrigated under non-equipped flood recession	0	72	
Irrigated area by Water Source			
Surface waSter	61613	58822	95.5
Ground water	4892	4666.8	95.4
Reuse of agricultural drainage water	901	901	100
Others			
Irrigated area by Water abstraction method			
Dam	1569	1545	98.5
River Diversion/Spring	44966	42013.75	93.4
Power/pump	20709	20669	99.8
Irrigated area by ownership			
Community	34722	33760	
Public	31835	29842	
Commercial farm	686	625	
Individual	1	1	

Show also
Agricultural Water Withdrawal, Environment and Health by water source
Socioeconomic Information on Community Irrigation Schemes
<Back to Irrigation

Figure 23: Irrigated Area

Contact Info
Related Links
Comments
Contacts

Agricultural Water
Irrigation
Livestock
Cropping Pattern
Soil and Water
Conservation
Profile

Agricultural Water Withdrawal, Environment and Health Awash River Basin for 2008

Agricultural water withdrawal	**Unit**	**Amount**
Irrigation	BCM	1.422
Livestock Water Use	BCM	0.106
Water withdrawal by water source		
Surface water	BCM	1.348
Groundwater	BCM	0.095
Reuse of agricultural drainage water	BCM	0.022
Others	BCM	
Drainage	**ha**	
Drained area equipped for Irrigation	ha	89
Drained area non-equipped for Irrigation	ha	
Environment and Health		
Area abandoned due to salinity	ha	37
Area waterlogged by irrigation	ha	0
Irrigation affected by flooded	ha	14
Area waterlogged, non-irrigated	ha	0
Population affected by water related diseases	No	0

Show also
Area under Agricultural Water Management
Socioeconomic Information on Community Irrigation Schemes
<Back to Irrigation

Figure 24: Water withdrawal, environment and health

Contact Info
Related Links
Comments
Contacts

Agricultural Water
Irrigation
Livestock
Cropping Pattern
Soil and Water Conservation
Profile

Socioeconomic Information on Community Irrigation Schemes Awash River Basin for 2008

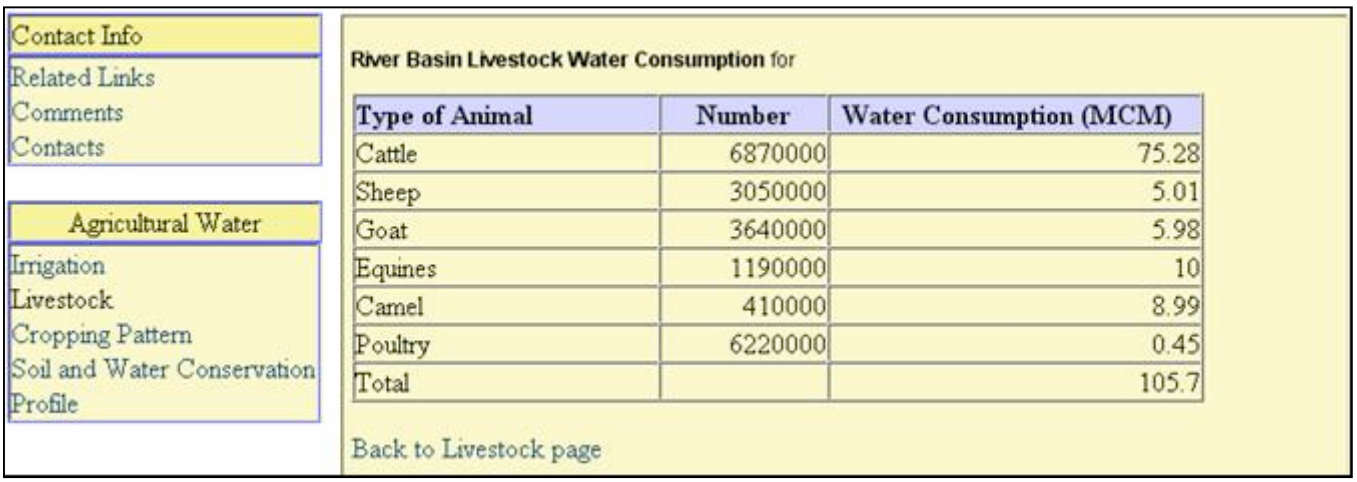
Description		Result
Number of Initial/Planned beneficiaries		22174
Number of Actual beneficiaries		59742
Number of Actual male beneficiaries		43223
Number of Actual female beneficiaries		5217
Women beneficiaries as % of total beneficiaries		8.7
Average irrigated land size (ha/hh)		0.59
Number of irrigation schemes in the database:		
	Public irrigation scheme	5
	Commercial irrigation schemes	14
	Individual irrigation schemes	1
	Community irrigation schemes	501
Number of Semi-functional irrigation schemes		36
Number of Non-functional irrigation schemes		1
Number of community irrigation schemes with:		
	Traditional organizations	246
	Cooperative/water user association	95
	No payment of water charges	484
	Water charges by crop type and area	1
	Water charges by area	13
	Equal payment of water charges	3
Total Number of members in Executive Committees		929
Number of women in Executive Committees		20
Number of schemes with Irrigation reduced due to:		
	Upstream abstraction	68
	Natural flow reduction	10
	Damage on headwork	9
	Damage on canal	4
	Natural flow reduction & headwork damage	
	Upstream users and & headwork damage	
	Natural flow reduction & canal damage	
	Upstream users & canal damage	
	Other reasons	1
…		
…		
Covering maintenance cost		
Users' annual water charge		
Users' contribution when the problem occurs		191
Users' annual water charge and woreda/region		
Users' contribution and woreda/region		
Others		

Show also
Area under Agricultural Water Management
Agricultural Water Withdrawal, Environment and Health by water source
<Back to Irrigation

Figure 25: Socioeconomics indicators of irrigation schemes

5.1.4 Livestock

The selection of **Livestock** from the left list followed by the selection of the year and location from the activated page and clicking **Show** button will a page that shows information on "**Livestock Water Consumption**" shown in Figure 26 will be displayed.

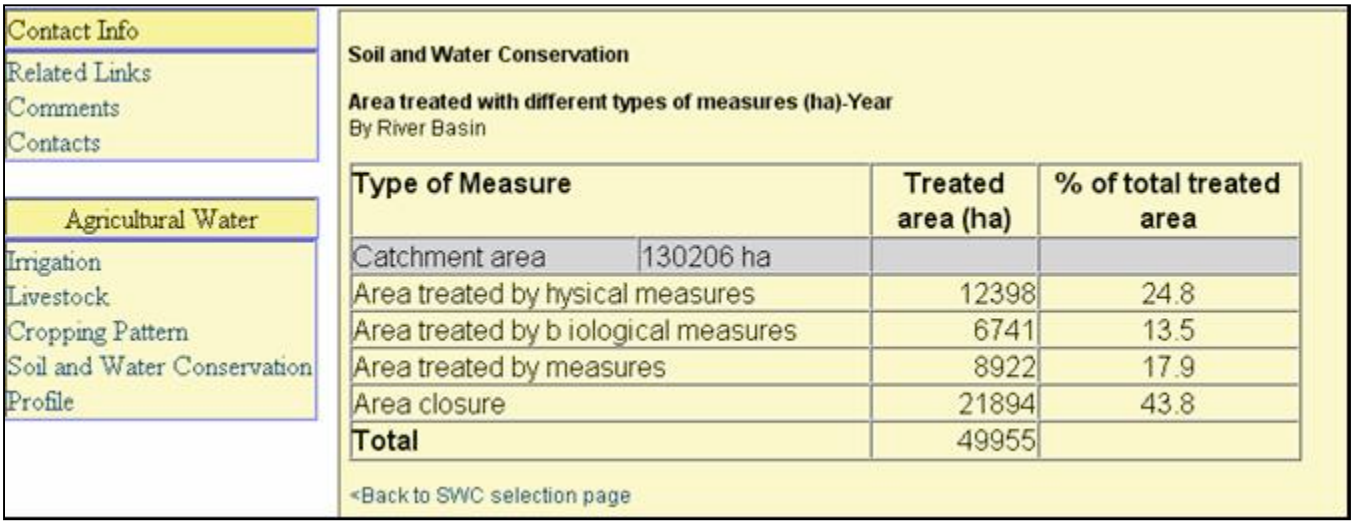


Type of Animal	Number	Water Consumption (MCM)
Cattle	6870000	75.28
Sheep	3050000	5.01
Goat	3640000	5.98
Equines	1190000	10
Camel	410000	8.99
Poultry	6220000	0.45
Total		105.7

Figure 26: Livestock Water Consumption

5.1.5 Soil and Water Conservation

By similar token, the selecting soil and water conservation will lead to a page for selection of year and location. Selection year and location followed by clicking **Show** button will display the page shown in Figure 27.



Type of Measure		Treated area (ha)	% of total treated area
Catchment area	130206 ha		
Area treated by hysical measures		12398	24.8
Area treated by b iological measures		6741	13.5
Area treated by measures		8922	17.9
Area closure		21894	43.8
Total		49955	

Figure 27: Soil and Water Conservation: location for Year

5.1.6 Cropping Pattern and Production Data

Selecting cropping pattern will lead to criteria selection page: year and location (country, region or river basin). Once these are selected, the page shown in Figure 28 will be displayed indicting the cropping patter of that particular year at country, river basin or region level. Total production and average yield (ton/ha) by type of crop will be shown for those irrigation schemes with recorded production data.

Contact Info

Related Links
Comments
Contacts

Agricultural Water

Irrigation
Livestock
Cropping Pattern
Soil and Water Conservation
Profile

Cropping Patterns, Awash River Basin for 2008

Crop	Area (ha)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Product (ton)	Yield (ton/ha)
Cereals															
Wheat	1211	0.2	0.3	0.3	0.3	0.4	0.9	1.2	1.2	1.2	1.4	1.3	0.4	7258	6
Rice	3						0	0	0	0	0	0	0	11	3.3
Barley	2833	1.2	1.4	1.4	1.3	1.3	1.6	3	2.9	2.9	2.6	2.6	2.6	8789	3.1
Maize	5119	1.2	1.5	2	1.6	2.6	3.4	4.9	4.9	5.1	5.7	2.8	1.4	15301	3
Millet	249	0.4	0.4	0.4	0.4	0								981	3.9
Sorghum	2864	0	0	0	0.5	2.3	2.7	3.6	2.2	2.5	2.6	1.9	1.3	12072	4.2
Teff	4825	1.2	2	3.1	2.5	1.9	1.6	3.9	3.9	3.9	3.2	1.8	0.7	16067	3.4
Other cereals															
Vegetables															
Onion	9872	7	7.9	9.2	8.7	4.5	3.6	2.6	3.1	4.1	5.4	4.6	3	108551	11.1
Tomato	1679	1.4	1.4	1.9	1.5	1	0.9	0.3	0.5	0.6	0.7	0.6	0.2	21376	12.8
Carrot	915	0.6	0.7	0.7	0.3	0.1	0	0	0	0	0.7	0.7	0.7	5012	5.5
Cabbage	1859	0.9	1	1.1	0.7	0.8	0.7	0.8	0.8	1.1	1.1	1.2	1	18619	10.8
Pepper	1997	0.8	0.9	1.1	0.8	1	0.9	1	1	1.4	1.5	1.3	1	4711	2.4
Swiss chard	3	0	0	0	0	0	0			0	0	0	0	15	5.5
Pulses															
Chickpeas	471	0.6	0.7	0.7	0.3	0.2	0	0	0	0	0	0.1	0	3362	7.4
Beans	404	0	0	0	0	0	0.5	0.6	0.6	0.6	0.6	0.2	0.1	1584	3.9
Pea	1781	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4	9064	5.1
Lentils	1617	1.3	1.4	1.4	2.2	1.9	1.8	1	0	0	0.2	0.2	0.2	5400	3.3
Groundnuts	1	0	0	0	0									2	1.8
Root crops															
Potato	3971	2.6	3	3.1	3	1.4	0.6	0.5	1.3	2.1	2.8	2.7	1.9	29170	7.4
Sweet potato	172	0	0	0.1	0.1	0	0	0.1	0.1	0.1	0.1	0.1	0.1	1925	11.2
Beet roots	585	0.1	0.1	0.1	0.1	0.1	0	0	0	0.3	0.7	0.7	0.7	3861	6.8
Other root crops	0	0	0	0										1	16.7
Fiber Crops															
Cotton	10335	0	0	0	16.2	16.1	16.1							26853	2.6
Oil crops															

Figure 28: Cropping pattern of location (country or River Basin or Region) for 2008.

.

5.1.7 Profile

As indicated earlier, a short description of the country, river basin or region can be accessed either from the menu or from the option list in the left of the **Home Page**. In this case only the profile of Awash Basin is available. Selection of this will similarly activate a page for the selection of country/river basin/region. When the level is selected as shown in Figure 29 above, the short text summarizing general features of the basin/country or region will be displayed in the middle screen listing the subjects or topics contained in the Profile below the option list in the left. The profile text can be read by scrolling down/up the text or a specific subject can be accessed by clicking the subject. Clicking **Top of Page** can take to the first or top page of the profile.

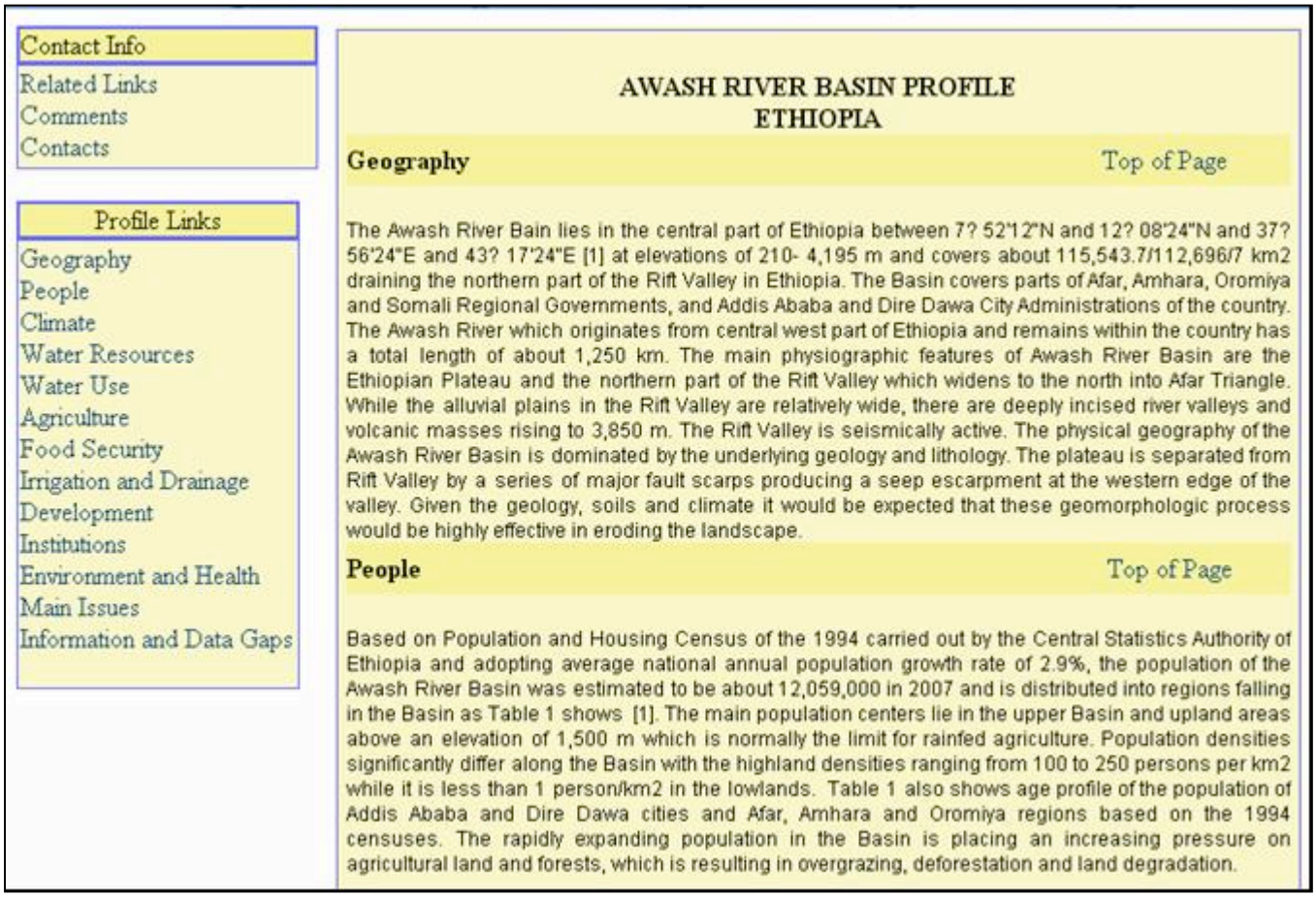


Figure 29: Profile Page

5.1.7 Maps

When Map is selected from the menu, a page showing map icons on the left and top of the page will be displayed. Clicking on the desires map icon will display enlarged map with relevant brief descriptions below the map. Clicking the link at the bottom of the map or description with blue text, will display the map with legend or in or PDF format in a separate window.

For example, clicking on irrigation site icon will display map of irrigation schemes surveyed in Awash River Basin as shown in Figure 230. Clicking on the "**Open Map in PDF**" will open the map in PDF format in separate window which can be printed.

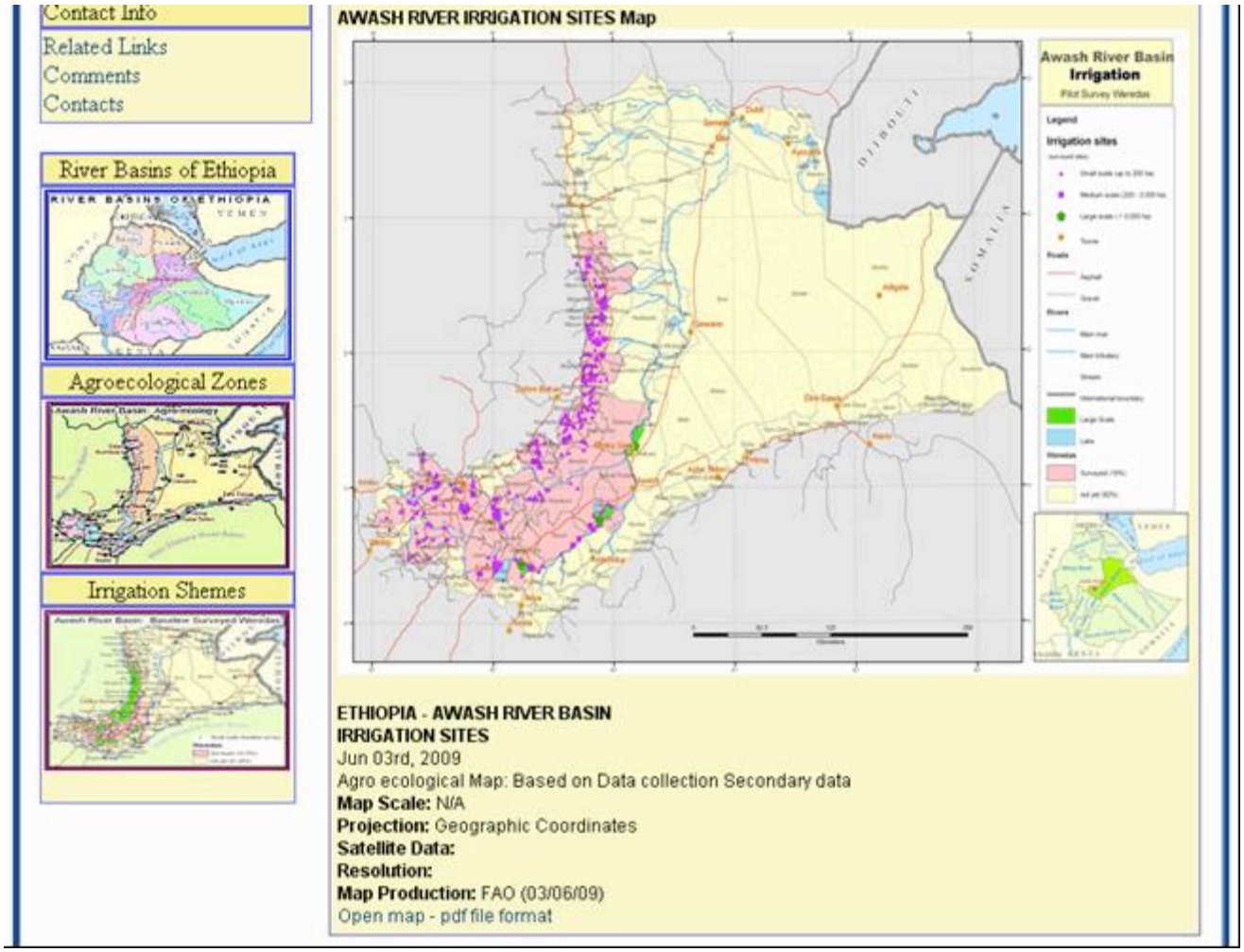


Figure 30: Map showing Areas covered by the Pilot Baseline Survey

5.2 Exporting Raw Data

Raw data may be required for making additional analysis other than the query included in the database system. This required querying raw data and exporting it. A tool is included export the complete raw data of an irrigation scheme to Excel. The tool for exporting the data is available only for registered users as shown in Irrigation Data Entry page.

The procedure for exporting the raw data is described below.

- The registered user will log in as explained under section 2.5 above.
- Click on the " Click Here to export Raw Data
- A dialogue box will be displayed asking for opening or saving the file in Excel.
- Select either open or save but saving the file is better. Hence, click on **Save**
- A File Save dialogue box will be opened showing a file name. Save the file with the default finale name or save it with another name.
- The File Save dialogue box will close after the saving and the Admin User Page will be displayed.

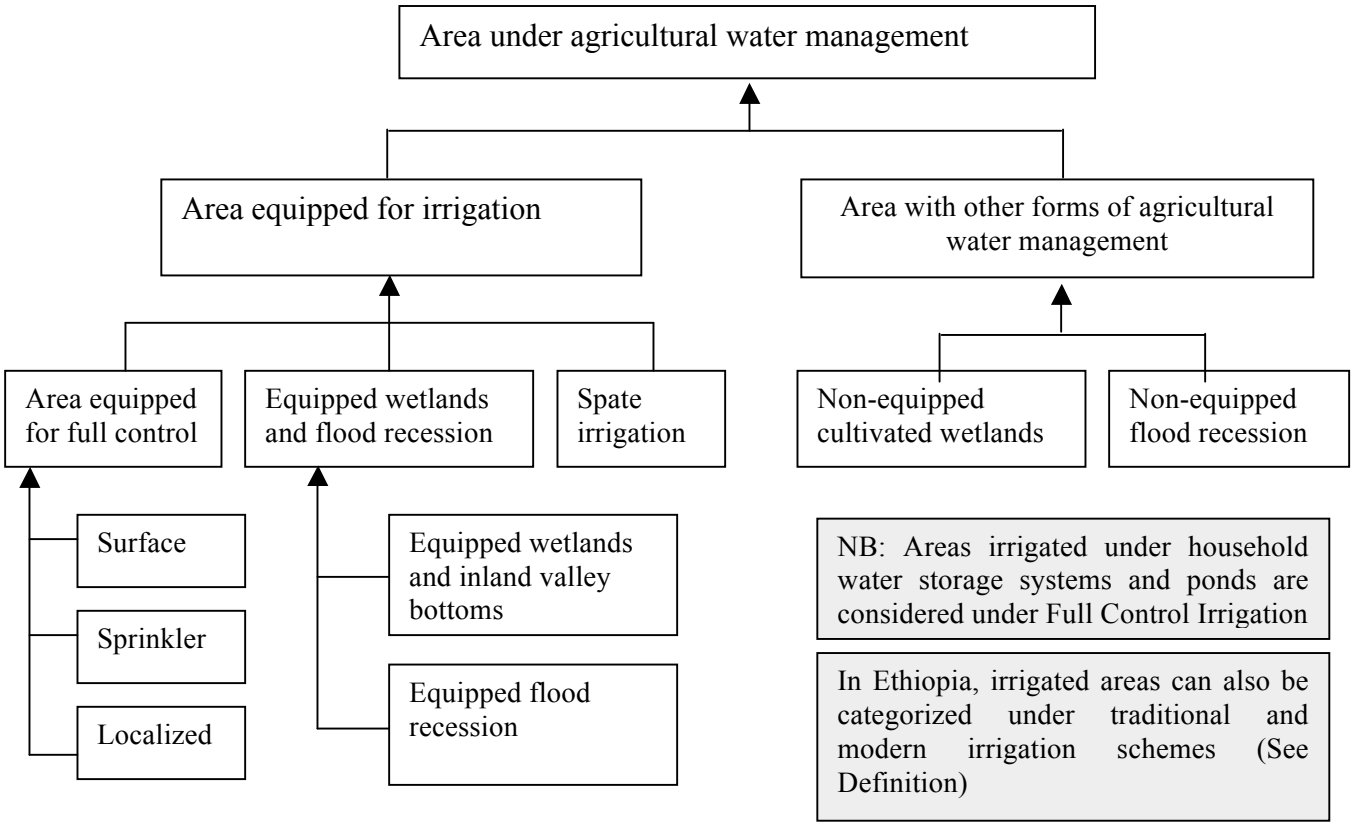
6. CALCULATIONS AND QUERIES

6.1 General

The database performs several calculations to present aggregate data including irrigated area at different scales, control systems, water sources, water abstraction methods and agricultural water use as well as some environmental and socio economic indicators based on data on individual irrigation schemes included in the database. One calculation can take data from different pages based on criteria. Calculations are activated simply by selecting the required criteria, i.e year and level (country, river basin and region).

For ease of understanding the calculations, Figure 31 shows the categories of areas under different water management.

Figure 31: Categories of Area under Agricultural Water Management



6.2 Calculations of Indicators and Variables

6.2.1 Codes of Variables

To simplify the understanding of calculations, the variables and indicators are coded as follows.

Water Resources and Use

[1000]	=	Total fresh renewable water = [1001] + [1002]
[1001]	=	Surface Water
[1002]	=	Ground Water
[1003]	=	Reuse of agricultural drainage water
[1004]	=	Other water sources
[1010]	=	Irrigation potential [ha]
[1100]	=	Total Agricultural water withdrawal =([1101] or [1102] or [1103]) + [1104]
[1101]	=	Actual water use for irrigation
[1102]	=	Estimated water abstraction for irrigation
[1103]	=	Estimated irrigation water requirements
[1104]	=	Livestock water use
[1105]	=	Agricultural water withdrawal as a % of renewable fresh water resources

Irrigated area

[2016]	=	Total area irrigated under other forms of water management (non-equipped irrigation systems)
[2029]	=	Total area equipped for irrigation
[2044]	=	Total equipped area actually irrigated
[2055]	=	Total area actually irrigated = [2016] + [2044]
[2085]	=	Equipped area as a percentage of total irrigation potential =100*[2055]/[1010]
[2086]	=	Actually irrigated area as a percentage of total equipped area for irrigation (100*[2055]/ [2029])
[2000-2028]	=	Area equipped for irrigation by scale, typology, control level, water source and water abstraction method
[2030-2054]	=	Actually irrigated area by scale, typology, control level, water source and water abstraction method
[2060]	=	Actually irrigated area as a percentage of equipped area
[2061-2084]	=	Actually irrigated area as a percentage of equipped area for irrigation by scale, typology, control level, water source and water abstraction

Drainage and Environment

[2100]	=	Area drained (irrigated), ha
[2101]	=	Area drained (non-irrigated), ha
[2102-2105]	=	Irrigated area abandoned due to salinity, waterlogging, flooding and erosion

6.2.2 Calculations

The calculations of main indicators and sub-indicators are explained below.

Indicator 1: Agricultural water withdrawal as a percentage of total fresh water resources

$$TRWR = SWR + GWR \quad [1000] \qquad (1)$$

These are secondary data are from the MoWR and in order to enable calculation, a Table which cannot be displayed is included in database and the water resources data are manually inserted in the calculation.

$$EIWA = \sum_{1}^{m} EIWAi \quad [1101] \qquad (2)$$

$$AIWU = \sum_{1}^{m} AIWUj \quad [1102] \qquad (3)$$

$$IWR = \sum_{1}^{m} LWRi \quad [1103] \qquad (4)$$

$$LWC = 365.25 \sum_{1}^{w} \sum_{1}^{n} LWCi \quad [1104] \qquad (5)$$

LWCj = Livestock number by type*Daily water use rate by livestock type /1000, 000, 000,000 (5)

AWW= LWC + (IWR or AIWU or EIWA) (6)

In the current case, neither AIWU nor EIWA is available. Hence, the IWR is used in the estimation of total agricultural water withdrawal.

The indicator is then calculated from

$$AWWP = 100 \frac{AWW}{TRWR} \qquad (7)$$

Where,

AWWP =	AWW as a percentage of TRWR
TRWR =	Total renewable water resources (BCM)
SWR =	Surface water resources (BCM)
GWR =	Ground water resources (BCM)
AIWU =	Actual irrigation water use (BCM)
EIWA =	Estimated water abstraction for irrigation
IWR =	Irrigation water requirement or actual water use (BCM)
LWC =	Livestock water consumption (BCM)
AWW =	Agricultural water withdrawal (BCM)
m, w & n =	Number of irrigation schemes, woreda and type of livestock respectively
i, and j	Counting numbers of water use per irrigation scheme and livestock type respectively

=

Indicator 2: Area of land under irrigated agriculture or under improved rainwater agriculture by type of system (ha)

$$As = \sum_{1}^{cl} As_i + \sum_{1}^{st} Asp_y + \sum_{1}^{wd} Aw_z + \sum_{1}^{fr} Af_t + \sum_{1}^{Rwh} Arw_k \quad (8)$$

$$Ap = \sum_{1}^{sp} Asp_j \quad (9)$$

$$Ad = \sum_{1}^{dp} Ad_g \quad (10)$$

A_T=As + Ad + (11)

Indicator 3: Irrigated area under Advance irrigation system as a percentage of total irrigated area

Then the indicators are calculated as follows:

$$Asfp = \frac{100xAs}{A_T} \quad (12)$$

$$Aspp = \frac{100xAsp}{A_T} \quad (13)$$

$$A_{dp} = \frac{100xA_d}{A_T} \quad (14)$$

Where,

At	=	Total area equipped for irrigation (ha)
As	=	Total area equipped under surface irrigation systems
Ap	=	Total area equipped under sprinkler irrigation systems
Ad	=	Total area equipped under drip irrigation systems
Asp	=	Total area under equipped spate irrigation systems
Aw	=	Total area under equipped wetland irrigation systems
Asp	=	Surface irrigated area as a percentage of total irrigated area
Aspp	=	Sprinkler irrigated area as a percentage of total irrigated area
Adp	=	Sprinkler irrigated area as a percentage of total irrigated area

The variables cl, st, wd, fr, rwh, sp and dp are number of irrigation schemes under different systems/typologies and i, y, z, t, j, and g are corresponding counting numbers.

Indicator 4:	**Area treated by soil and water conservation measures by type of measure**

$$Ap = \sum_{1}^{Wp} Api \qquad (14)$$

$$Ab = \sum_{1}^{Wp} Abi \qquad (15)$$

$$Abp \sum_{1}^{Wp} Abpi \qquad (16)$$

$$Ac = \sum_{1}^{Wp} Aci \qquad (17)$$

Acon = Ap + Ab + Abp+ (18)

Where,
Acon= Total area treated by soil conservation measures
Ap= area treated by physical soil conservation measures
Ap= area treated by physical soil conservation measures (ha)
Ab= area treated by biological soil conservation measures (ha)
Abp= area treated by both physical and biological soil conservation measures
Ac= area enclosed for natural regeneration

Development of cropping pattern

A following cropping pattern model was developed based on the following assumptions:

- Full months for planting and harvesting
- Minimum LGP of 3 months per season
- Maximum LGP of 6 months per season
- No production for November and December planting

$$ACi = \sum_{m=1}^{12} C_i P_m - \sum_{m=1}^{12} C_i H_{m-3} - \sum_{m=7}^{12} C_i P_{m-6}$$

Where
ACi= Area covered by of crop i
Ci = Crop type i
Pm= Planting month number m
Hm= Harvestimg month number m
i = Number of crops
m= counting number of months

Average yield is estimated for those irrigation schemes for which production data recorded.

Annex 1: Description of Calculations

Annex 1.1 Agricultural Water Withdrawal, Environment and Health

Agricultural water withdrawal	**Unit**	**Amount**
Irrigation water use	BCM	See **Equations 2-4** above for Calculation
Livestock Water Use	BCM	See **Equation 5** above for Calculation
Water withdrawal by water source		
Surface water	BCM	Sum of all actual water use [1101] or estimated water abstraction [1102] or irrigation water requirements [1103] with the criterion "**surface water**"
Groundwater	BCM	Sum of all actual water use [1101] or estimated water abstraction [1102] or irrigation water requirements [1103] with the criterion "**Ground water**"
Reuse of Agricultural drainage water	BCM	Sum of all irrigation water requirements [1103] with the criterion "**with this water source for irrigation**"
Others	BCM	Sum of all irrigation water requirements [1103] with the criterion "**others**" –other source of water
Drainage		
Drained area equipped for irrigation	ha	Sum of drained areas that equipped for irrigation
Drained area non-equipped for irrigation		Sum of drained areas that are not equipped for irrigation
Environment and Health		
Area salinized and cultivated	ha	Sum of areas equipped for irrigation that area affected by salinity but are still cultivated
Area abandoned due to salinity	ha	Sum of areas abandoned equipped for irrigation that area no ore cultivated due to salinity
Area waterlogged by irrigation	ha	Sum of irrigated areas waterlogged due to irrigation
Irrigated area affected by flood	ha	Sum of areas equipped for irrigation that are affected by flood
Irrigated area eroded	ha	Sum of areas equipped for irrigation that are affected by erosion due to inappropriate irrigation practices
Area waterlogged, non-irrigated	ha	Sum of waterlogged areas that are not irrigated (rainfed cultivated or other areas)
Population affected by water related diseases due to irrigation	No	Sum of population affected by diseases due to irrigation

BCM= Billion (1,000,000, 000) cubic meter

ha= hectare

Annex 1.2: Equipped and Actually Irrigated Areas by different categories

Description (1)	Area equipped for irrigation (ha) (2)	Actually irrigated area (ha) (3)	Actually irrigated area as % of equipped area (4)
Irrigated area by scale	**[2000]**	**[2030]**	**(4)=100*(3)/(2)**
Water harvesting and areas<2.5 ha	Simple summation of data with criteria	Simple summation of data with criteria	
Small scale (up to 200 ha)			
Medium scale (200-3000 ha)			
Large scale (>3000 ha)			
Irrigated Area by Typology			
Traditional Irrigation			
Modern Irrigation			
Total area under AWM by control level			
Full Control			
Surface			
Sprinkler			
Drip			
Partial control			
Area irrigated under equipped wetlands and flood recession			
Area equipped under spate irrigation			
Irrigated area with other forms of agricultural water control			
Area irrigated under non-equipped wetlands			
Area irrigated under non-equipped flood recession			
Irrigated area by Water Source			
Surface water			
Ground water			
Reuse of agricultural drainage water			
Others			
Irrigated area by Water Abstraction			
Dam			
River diversion/spring			
Pump			

Annex 1.3: Agricultural Water Withdrawal by River Basin (this is only at country level)

River Basin (1)	Irrigation potential (ha) [1010] (2)	Area equipped for irrigation [2029] (3)	Equipped as a % of irrigation potential [2085] (4)	Actually irrigated area [2055] (5)	Actually irrigated as % of equipped area for irrigation [2086] (4)	TRWR (BCM) [1000] (6)	IWW (BCM) [1100] (10)	Proportion of AWW as a % of TRWR [1105] (11)
1. Wabishebelle	Data	Sum of data	100*[2029]/[1010]	Sum of data	100*[2055]/[1029]	Data	[1103]+[1104]	100*[1100]/[1000]
2. Abbay								
3. Genale Dawa								
4. Awash								
5. Tekeze								
6. Denakil								
7. Ogaden								
8. Omo-Ghibe								
9. Baro-Akobo								
10. Rift Valley Lakes								
11. Mereb								
12. Aysha								
Total								
Validation:			**[2085]<=100**	**[2055]<=[2029]**	**[2086]<=100**		**[1100]<[1000]**	**[1105]<=90**

IWW= Irrigation water withdrawal