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## Training Manual

# Geospatial Tool to Target Surface Water Irrigation for Crop Intensification in Southern Bangladesh

**Timothy J. Krupnik, Urs Schulthess, Abul Kashem Md. Hasan, Mohammad Shahidul Islam, Md. Abdul Hadi, Rajib Bhowmik**

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STARS

CSISA

CIMMYT MR
International Maize and Wheat Improvement Center

CEGIS Center for Environmental and Geographic Information Services
House 6, Road 23/C, Gulshan-1, Dhaka-1212, Bangladesh. Tel: 58817654, 58817650-52, Fax:880-2-8823128

**Training Manual: Geospatial Tool to Target Surface Water Irrigation for Crop Intensification in Southern Bangladesh**

Headquartered in Mexico, the International Maize and Wheat Improvement Center (known by its Spanish acronym, CIMMYT) is a not-for-profit agriculture research and training organization. The center works to reduce poverty and hunger by sustainably increasing the productivity of maize and wheat in the developing world. CIMMYT maintains the world's largest maize and wheat seed bank and is best known for initiating the Green Revolution, which saved millions of lives across Asia and for which CIMMYT's Dr. Norman Borlaug was awarded the Nobel Peace Prize. CIMMYT is a member of the CGIAR Consortium and receives support from national governments, foundations, development banks, and other public and private agencies.




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CIMMYT – Bangladesh
House 10/B, Road 53, Gulshan 2, Dhaka 1212
Tel (Land/Fax): +88 02 9896676; +88 02 9894278

Post: P.O. No. 6057, Gulshan, Dhaka 1213, Bangladesh

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# STARS Geospatial Tool
# to Target Surface Water Irrigation for Crop Intensification

## 1.1 Introduction

The Spurring a Transformation in Agriculture through Remote Sensing (STARS) Geospatial Tool to Target Surface Water Irrigation for Crop Intensification (http://202.53.173.179/cimmyt) has been developed to incorporate and visualize all primary and secondary geo-spatial data and information collected and generated by CIMMYT, CEGIS, IWM and the other STARS partners, with relevance for targeting the use of surface water for irrigation in Southern Bangladesh.

This is an open-source resource designed to have a user-friendly interface. We encourage our partners to make use of the information presented in the website, and to share the data and analyses widely through the creative commons licensing arrangement detailed above.

## 1.2 Components

The web portal (Figure 1.1) consists of six major components. They are as follows:

1. Home
2. Map Explorer
3. Methodology
4. Additional Resources
5. Administration
6. Contact Us


**Figure 1.1: Web Map Server Home Page**

### 1.2.1 Home Page

This page contains an overview of the STARS project. The user can also navigate to other components from this page.

### 1.2.2 Map Explorer

This is the main component of the portal. It displays spatial data such as the suitability of land for surface water irrigated agriculture, surface water presence, administrative boundaries, road networks, etc. Zoom in, zoom out, pan, super imposition and other standard facilities of a geographical information system (GIS) are available here. The Map Explorer also provides facilities to view identity and attribute information of the spatial data layers. The Map Explorer interface also contains two separate panels on the left and right.

#### 1.2.2.1 Left Panel

This panel contains *Map Layers* tree and *Map Filter* tree.

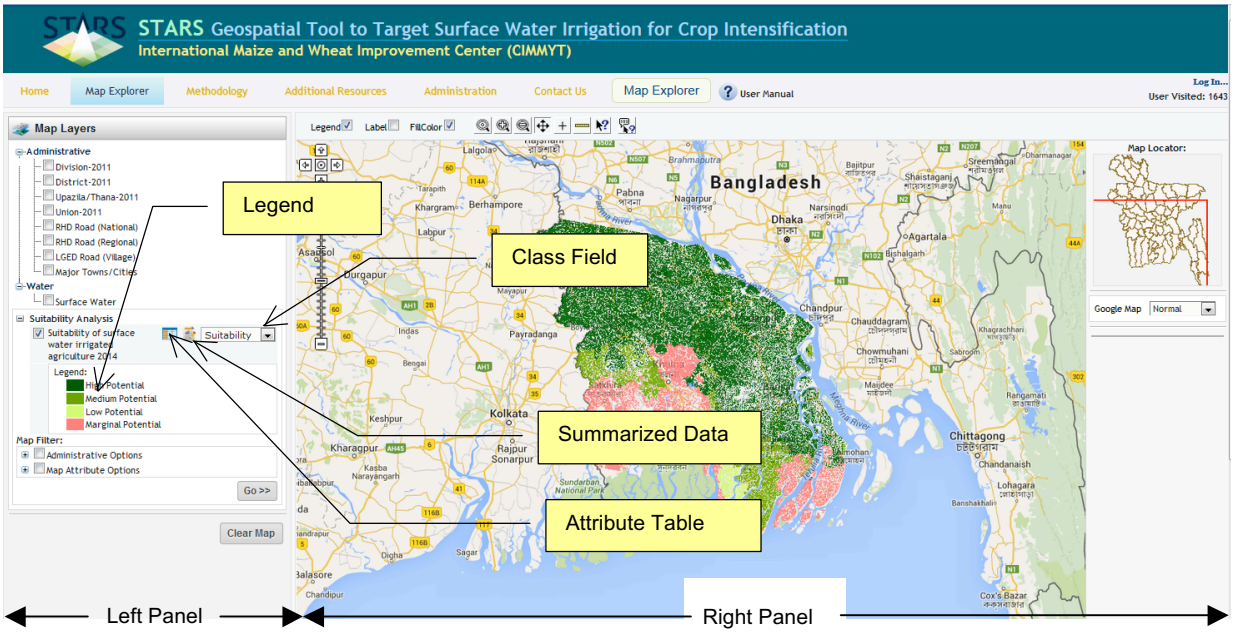



**Figure 1.2: Map Explorer**

**Map Layers Tree**

The data available in the database are categorized into different data groups for better management. Each data group contains several data layers. The *Map Layers* tree contains data groups as parent nodes and corresponding data layers as child nodes. Table 1.1 shows data groups and corresponding data layers used in the system.

**Table 1.1: Data Grouping**

| Data Group | Data layer |
|---|---|
| Administrative | Division-2011 |
| | District-2011 |
| | Upazila/Thana-2011 |
| | Union-2011 |
| | RHD Road (National) |
| | RHD Road (Regional) |
| | LGED Road (Village) |
| Water | Surface Water |
| Salinity | Suitability of surface water irrigated agriculture 2014 |

***Attribute Table Viewer**:* This button is used to view attribute table in a new popup window.

***Summarized Data**:* This button is used to summarize information based on Division, District, Upazila (sub-District), and other administrative or geographical parameters. Summarized data can be viewed as graph or chart and can be exported in excel, access, dbase or text.

***Class Field***: This combo-box can be used to change legend based on selected *Class Field*.

***Map Legend***: Here, the Map Legend will be displayed depending on the selected *Class Field*.

***Clear Map***: The *Clear Map* is used to clear or remove all the Map layers and data from the Spatial Data Viewer.

In order to view data, select Data Layers from the Left Panel as follows:

a) Expand a Data Group such as *Salinity* node from the *Map layers* tree.

b) Select a Data layer such as "Suitability of surface water irrigated agriculture 2014" by clicking the corresponding checkbox.

c) Data (Suitability of surface water irrigated agriculture 2014) will be displayed in the Right Panel.

*Soil salinity, Water Salinity, Admini*strative Boundaries and some other types of data layers can be viewed and analyzed. Data layers can also be overlaid or superimposed. For example, if a user wants to overlay "*Suitability of surface water irrigated agriculture 2014*" with "*Surface Water*", then she or he has to select "*Surface water irrigated agriculture 2014*" by checking the corresponding checkbox from the "*Water Salinity*" data group. After this, they would next select "*Surface Water*" by checking the corresponding checkbox from "*Water*" data group.

**Map Filter Tree**

This tree (Figure 1.3) contains two parent nodes: Administrative Options and Map Attribute Options. A node is a point at which one or more leaves (options) emerge. *Administrative Options* contains administrative units such as division, district and Upazila as its siblings. This option is used to filter data based on administrative units. On the other hand, *Map Attribute Options* contains different map attributes such as *Flood Class*, *Suitability*, *Crop Intensity*, *Soil Salinity*, *Water Salinity* etc. as its siblings. This option can be used to filter data based on different values of map attributes.

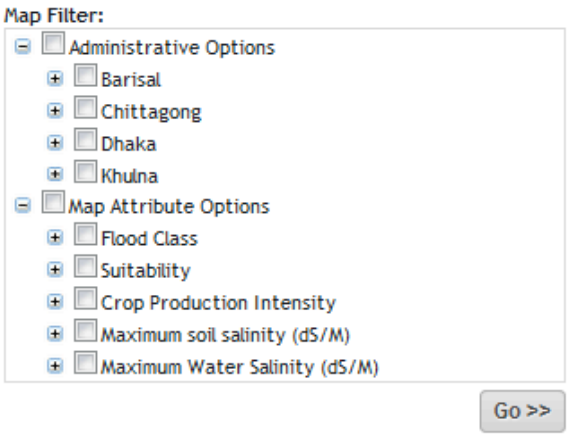



**Figure 1.3: Map Filter**

In order to filter data based on administrative units, follow the following steps:

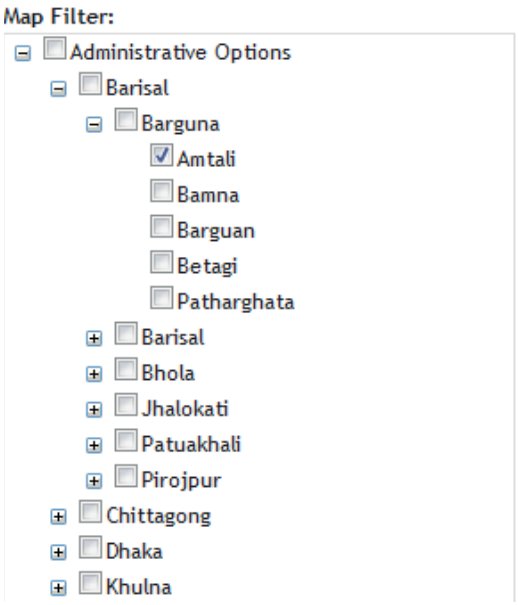



**Figure 1.4: Administrative Options**

a) Expand Administrative Options by clicking its corresponding node.

b) In order to filter data for a particular division, select the desired division by checking the corresponding checkbox. Multiple divisions can be selected at once if required.

c) In order to filter data for a particular district, expand the required division and then select the desired district by checking the corresponding checkbox. Multiple districts can be selected.

d) In order to filter data for a particular Upazila, expand the required division and then required district. Finally select the desired Upazila by checking the corresponding checkbox. Multiple Upazilas can be selected.

e) Press the **Go** button.

In order to filter data based on map attribute data, follow the following steps:

a) Expand Map Attribute Options by clicking corresponding node.

b) Expand an *Attribute* such as *Land Type* by clicking the corresponding node. Multiple attributes can be selected.

c) Select the desired attribute value such as *Highland* by checking the corresponding checkbox. Multiple value can be selected at once, if required.

d) Press the **Go** button.

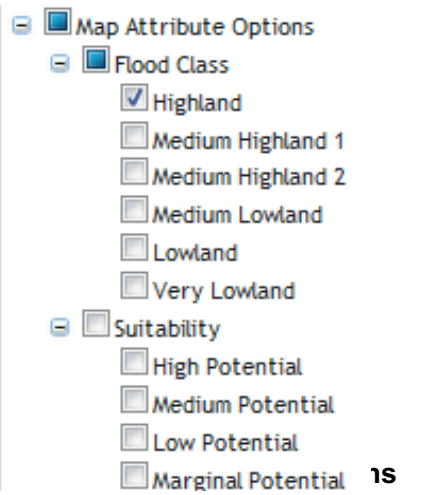



**Figure** **ns**

### 1.2.2.2 Right Panel

This panel is the Spatial Data Viewer that consists of three sub-panels, including the Top Panel, Left Panel and Right Panel.

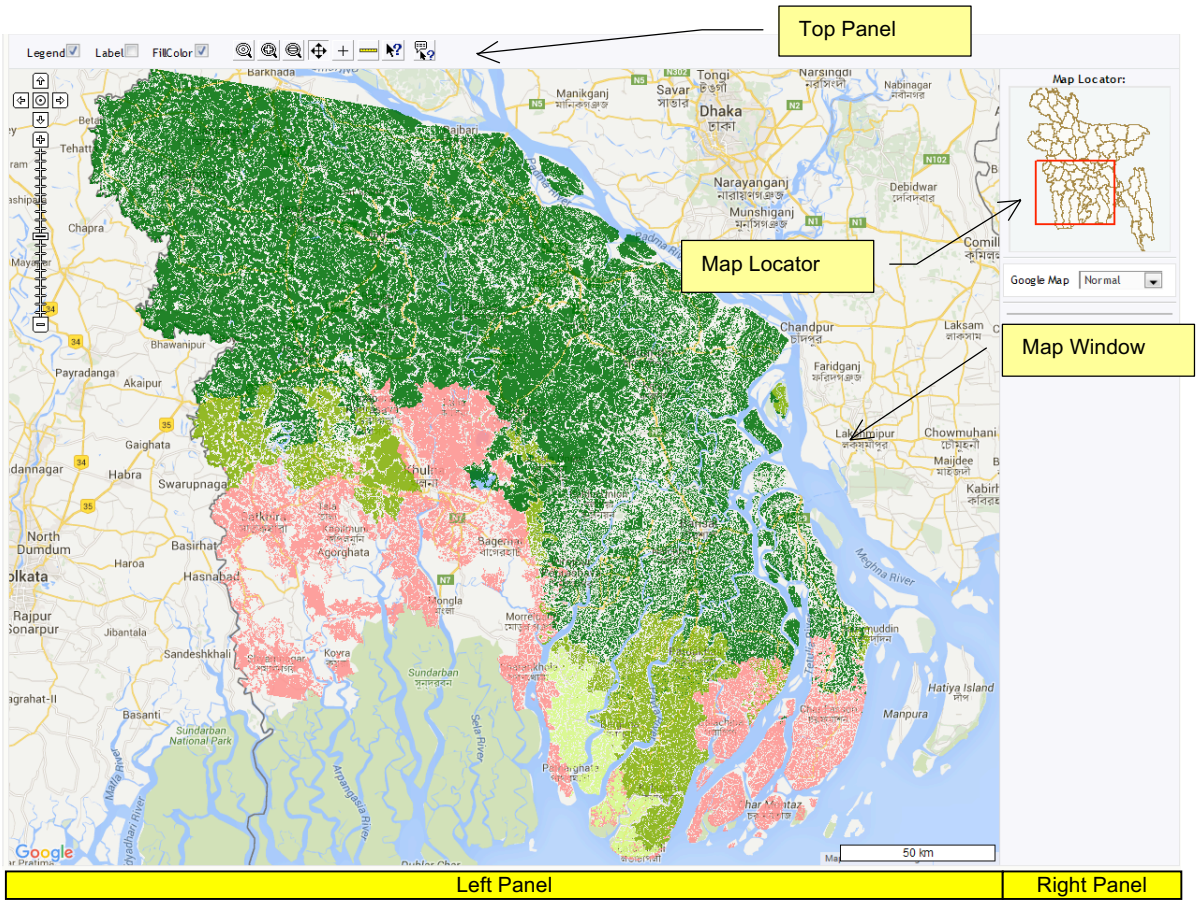



**Figure 1.6: Spatial Data Viewer**

**Top Panel:** This panel (Figure 1.7) contains Legend, Label and Fill Color checkboxes and a Map Toolbar.

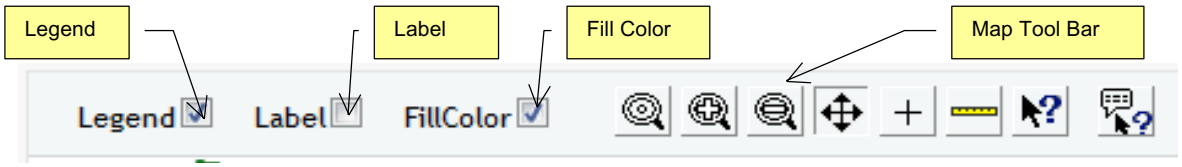



**Figure 1.7: Top Panel**

***Legend:*** This Check Box is positioned at the left most position of the Top Panel. It is used to activate/inactive the Map Legend by checking/un-checking it.

***Label:*** This Check Box is used to make the Map Label visible/invisible.

***Fill Color:*** This Check Box is used to fill/clear the Map colour.

***Map Toolbar:*** This contains several standard map tool buttons used for applying different functions on the maps available in the *Map Window*.

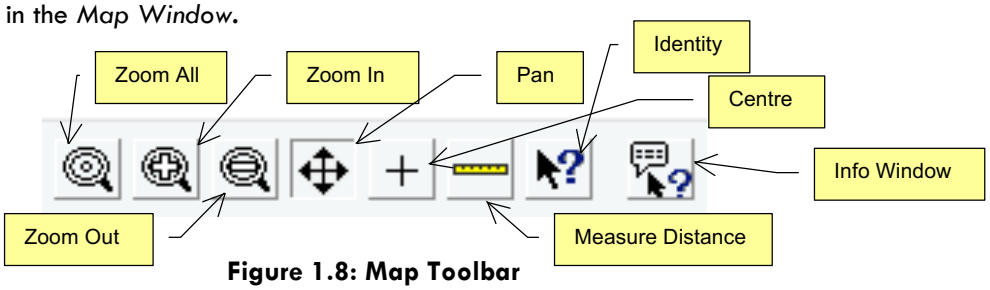



**Figure 1.8: Map Toolbar**

*Zoom All:* To display the layer to its fullest extent, click the *Zoom All* button.

*Zoom In:* To zoom in the layer at the selected point, first click the *Zoom In* button then click on the Layer at the point where you want to zoom in.

*Zoom Out:* To zoom out the layer at the selected point, first click the *Zoom Out* button then click on the layer at the point where you want to zoom out.

*Centre:* To centre the map layer, first click the *Centre* Button , and then click point on the *map layer*.

*Pan:* To pan the layer towards a direction, first click the *Pan* Button, then click and hold on the *map layer* and move.

*Measure Distance:* To measure distance from one location to another, first click the *Measure Distance* button, then click on points on the map layer to generate a measured result.

*Identity:* To view the identity information of a particular point or polygon on the layer, click the *Identity* button then click on the point. It will display the identity information (Figure. 1.9) of the point/ polygon (enclosed area) at the bottom of the *Map Locator*.

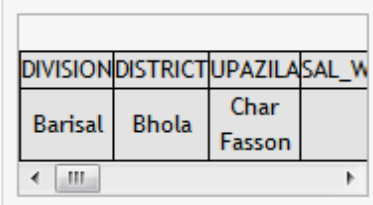



**Figure 1.9: Identity Information**

*Info Window:* To view the information of a particular point or polygon on the layer, click the *Info Window* button, then click on the point. It will display the information (Figure. 1.10) of the record described in the database of the point/polygon (enclosed area) at the bottom of the Panel.

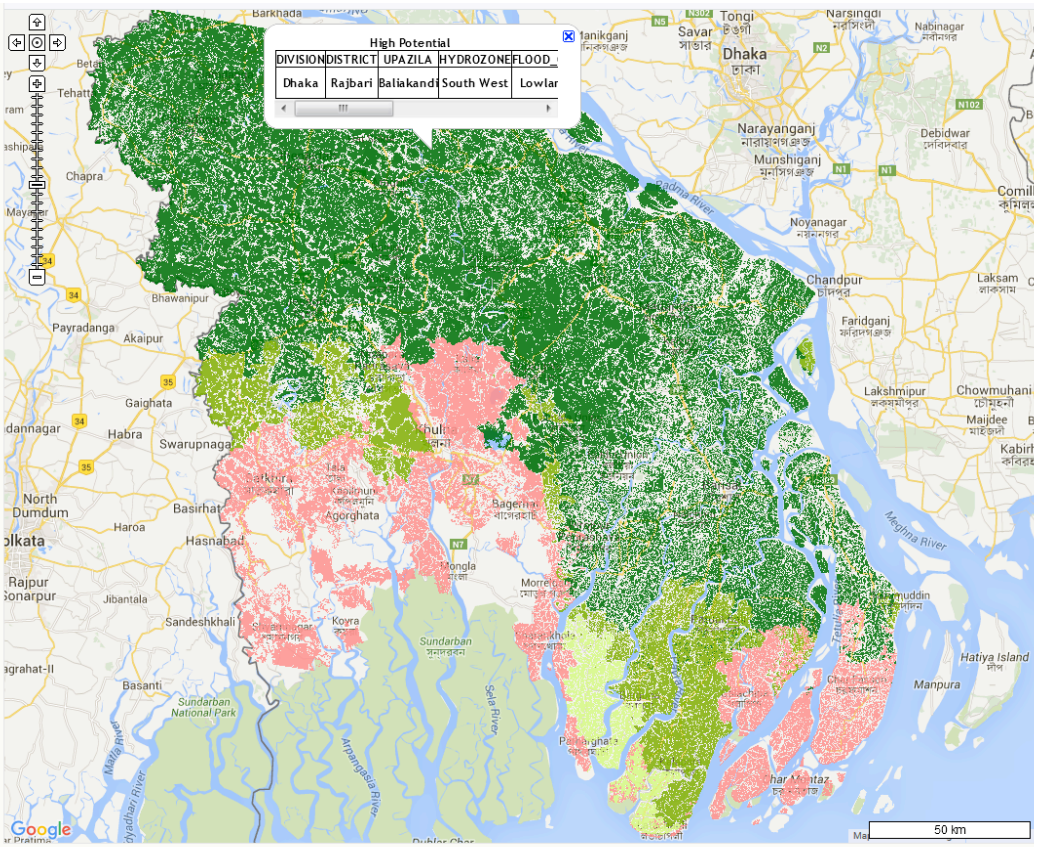



**Figure 1.10: Information Window**

**Left Panel:** This panel consists of a *Map Window*.

***Map Window:*** This window (Figure 1.11) is available at the left of this panel and is used to display the active map layers displaying high (deep green), medium (light green), and non-suitable (red) land that indicate the relative suitability of land area for surface water irrigation.

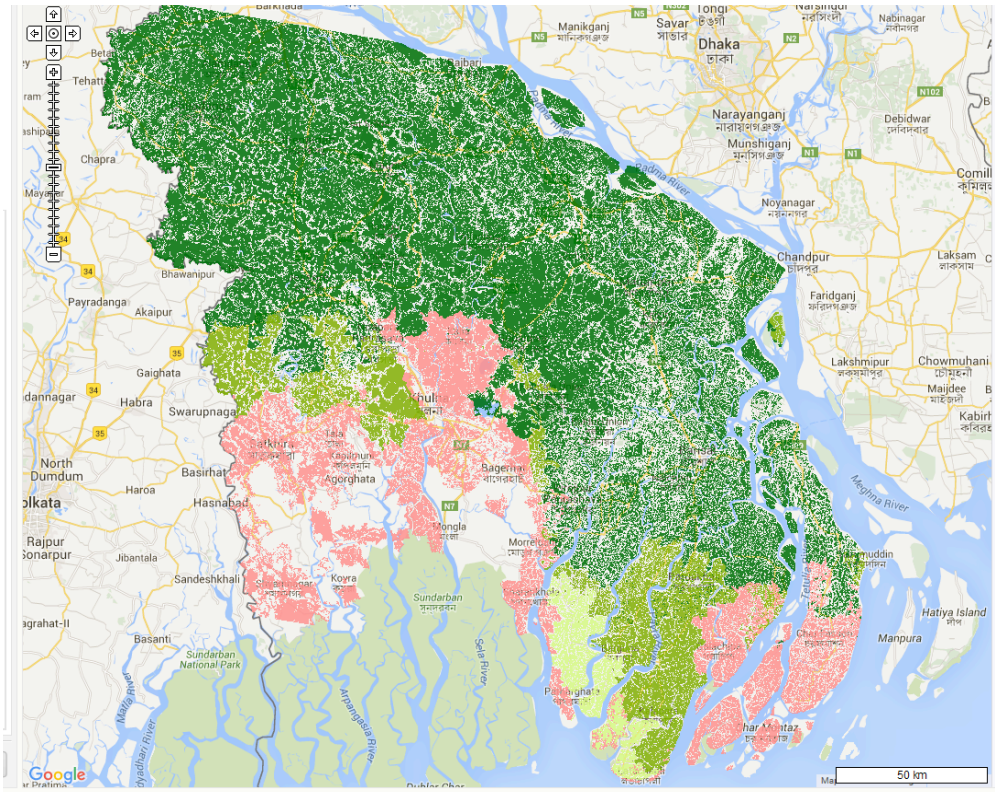



**Figure 1.11: Map Window**

**Right Panel:** This panel contains a Map Locator (Figure 1.12).

***Map Locator***: The *Map Locator* shows the position of the map view in the map window in respect to the map of Bangladesh. It is also use to change the position of the map view.

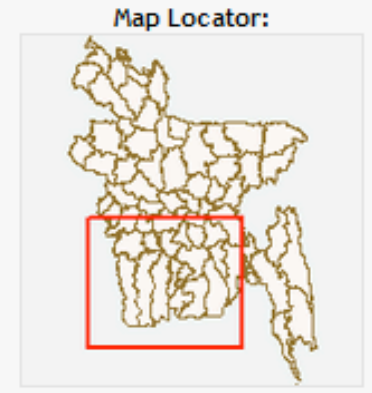
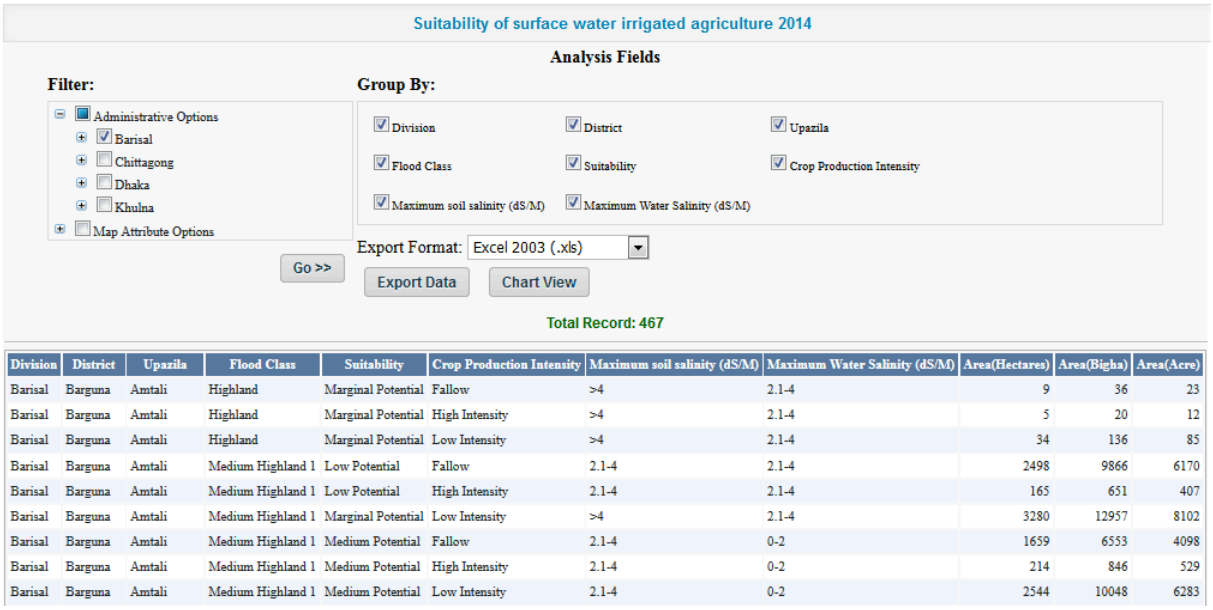



**Figure 1.12: Map Locator**

### 1.2.2.3 Summarize Data

*Data Layer* information can be summarized using the *Summarized Data* button. Clicking this button will open a pop-up window shown in Figure 1.13.




| Division | District | Upazila | Flood Class | Suitability | Crop Production Intensity | Maximum soil salinity (dS/M) | Maximum Water Salinity (dS/M) | Area(Hectares) | Area(Bigha) | Area(Acre) |
|---|---|---|---|---|---|---|---|---|---|---|
| Barisal | Barguna | Amtali | Highland | Marginal Potential | Fallow | >4 | 2.1-4 | 9 | 36 | 23 |
| Barisal | Barguna | Amtali | Highland | Marginal Potential | High Intensity | >4 | 2.1-4 | 5 | 20 | 12 |
| Barisal | Barguna | Amtali | Highland | Marginal Potential | Low Intensity | >4 | 2.1-4 | 34 | 136 | 85 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Low Potential | Fallow | 2.1-4 | 2.1-4 | 2498 | 9866 | 6170 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Low Potential | High Intensity | 2.1-4 | 2.1-4 | 165 | 651 | 407 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Marginal Potential | Low Intensity | >4 | 2.1-4 | 3280 | 12957 | 8102 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Medium Potential | Fallow | 2.1-4 | 0-2 | 1659 | 6553 | 4098 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Medium Potential | High Intensity | 2.1-4 | 0-2 | 214 | 846 | 529 |
| Barisal | Barguna | Amtali | Medium Highland 1 | Medium Potential | Low Intensity | 2.1-4 | 0-2 | 2544 | 10048 | 6283 |

**Figure 1.13: Summary of Data**

***Filter***: This option helps to filter the summarized data based on Division, District, Upazila and other attribute information such as land type (elevation/flooding class), suitability for surface water irrigation, crop production intensity, and soil salinity and water salinity. After selecting the required filter option and pressing the 'Go' button, the portal will display the summarized data that fulfill the selected filter criteria.

***Group By***: This option helps to group the summarized data based on Division, District, Upazila and other parameters such as land type, suitability, land use intensity, soil salinity and water salinity.

***Export Data***: This button helps to export summarized data into selected format. Before exporting data, user will have to login to the system using his/her user ID and password. After successfully logging in, user can export the data and download it into their local computer. The sequence of export actions are shown in Figure 1.14.

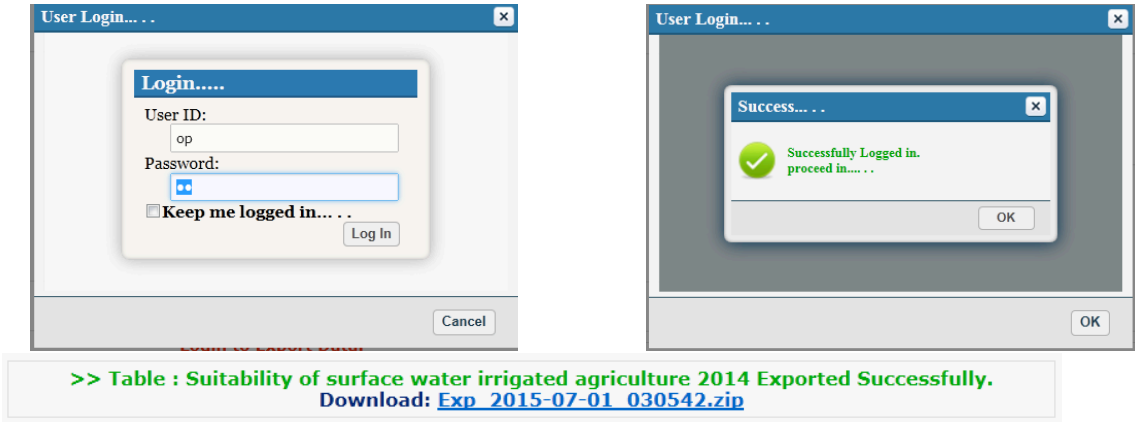



**Figure 1.14: Export Data**

***Chart View:*** This button helps to view summarized data as chart or graphs. In order to view graph, filter data for a particular administrative unit, for example '*Amtali*' Upazila and group data for a particular attribute such as 'Suitability'. After clicking on *Chart View* button the window shown in figure 1.15 appears.

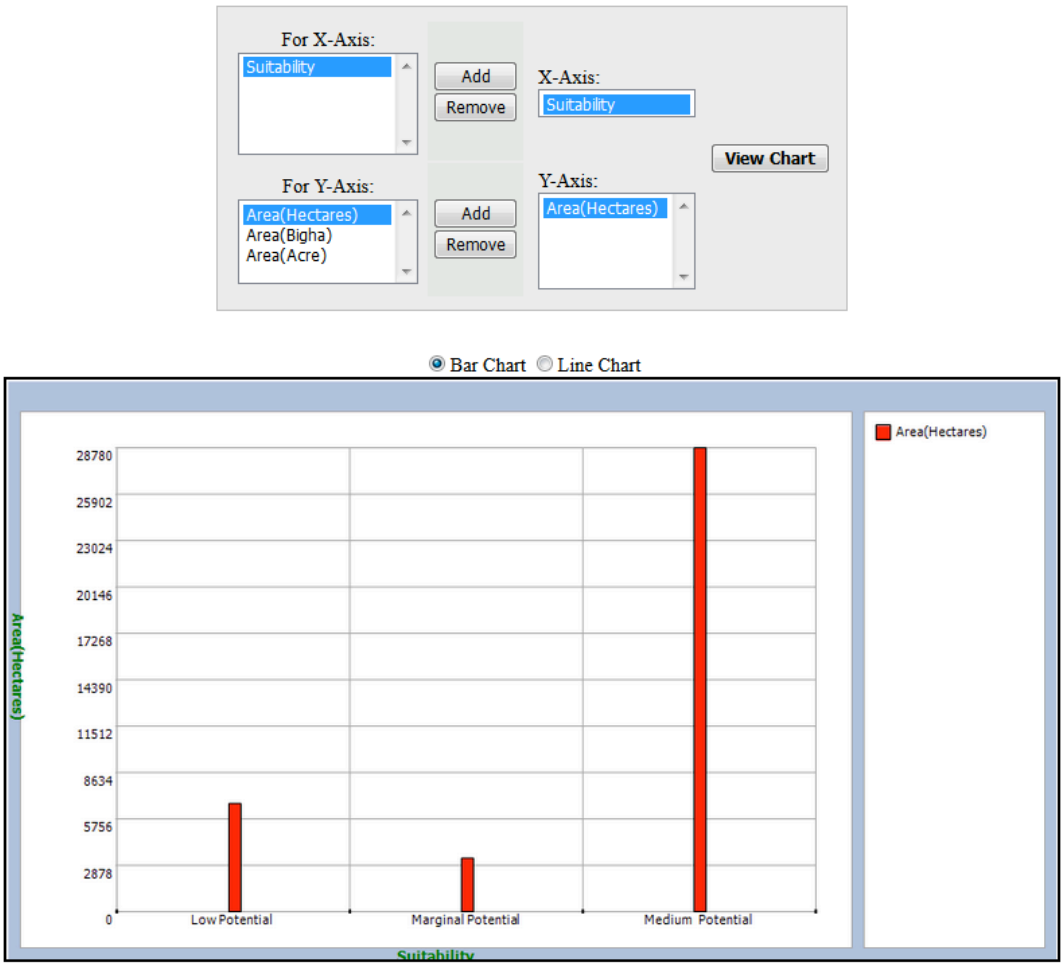



**Figure 1.15: Chart View**

In order to view a chart, follow the steps given below:

a) Select a field such as '*Suitability*' for the *X*-axis and click the *Add* button.

b) Select a field such as '*Area (Hectares)*' for the *Y*-axis and click the *Add* button.

c) Click the *View Chart* button.

d) The chart will be shown as bar graph by default.

e) Bar graph can be changed to a line graph by selecting the *Line Graph* option button.

### *1.2.3 Methodology*

This component helps to view the detail methodology of the development of the project.

### *1.2.4 Additional Resources*

This component helps to view selected reports, publications, etc. on the topic of cropping intensity and surface water irrigation in Bangladesh.

### 1.2.5 Administration

This component allows administrator to create new user as well as edit existing users. It also allows a user to change his/her password.

In order to update his/her information, the user can follow the steps given below:

a) Click the Administration link. Login window shown in figure 1.16 will appear.

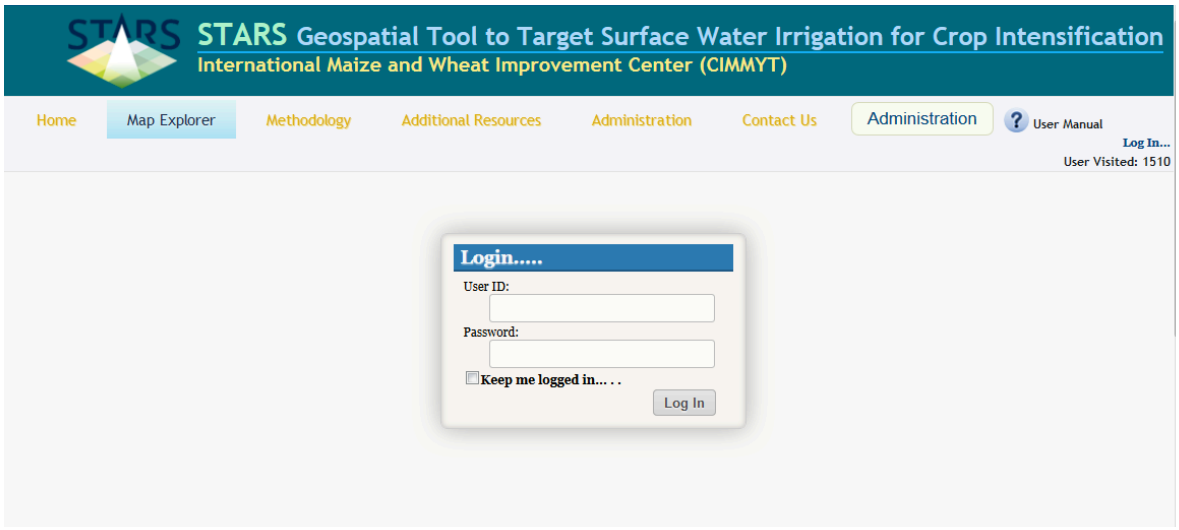



**Figure 1.16: Administration Module**

b) Enter your user id and password and press Log In button. The window shown in figure 1.17 will appear. Note the 'EEE' is simply a placeholder that will be replaced with your user specific information once you enter it.


**Figure 1.17: User Panel**

c) In order to edit information, click the Edit button. It will enable the User Panel for editing (figure 1.18).

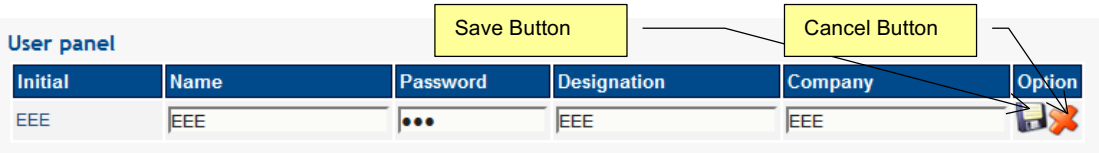



**Figure 1.18: Edit Information**

d) Update Name, Password, Designation or Company. Click the Save button.


**Figure 1.19: Save Updated Information**

e) A confirmation message shown in figure 1.24 will appear. Click the OK button to save the information.

### *1.2.6 Contract Us*

This component provides contract information for the developers of the geospatial tool.

## 1.3 Assignments of how to query the geospatial tool for data and to target irrigation

Some assignments are given below to provide a clearer understanding of the different component of the Web Map Server. We encourage users to work through these assignments in order to assure they are correctly operating the geospatial tool and getting the most out of its use.

1) Using the *Geospatial Tool to Target Surface Water Irrigation for Crop Intensification*" perform following exercise:

   a) Locate the High Potential area of "Atjuri" union of" Mollahat" upazila near "Village B Pacca" road.

   b) Analyze data and extract data on the amount of land that falls into the each Suitability category for dry season irrigated cropping (with respect to soil and surface water salinity) in Amtali Upazila. Report this information in a tabular format.

   c) In your respective Upazilla, analyze the data and display only the land that shows fallow and low intensity land. Represent this data as a graph comparing the two intensity classes.

   d) Display a map of Gopalganj District that will contain only land that is classified as medium potential for surface water irrigation and cropping, located on Medium Lowland and Lowland elevation classes. Answer in 3-4 sentences what this implies for the suitability of surface water irrigation, and potential choice of crops.

   e) Summarized data and export information on the amount of Fallow land that is High Potential land for surface water irrigation and increasing cropping intensity in Khulna division in excel 2003 format.

      i. Assuming that 50% of this land was cropped to *boro* rice with an average yield of 4 t/ha, how many tons of *boro* could be produced on this land?

      ii. What about on 75% and 100% of this land?

      iii. If a single axial flow pump can be used for 15 hectares of irrigation, how many axial flow pumps would be needed to provide surface water for *boro* irrigation on 50%, 75%, and 100% of this land?

      iv. Write 1-2 sentences about your result, and the constraints of this analysis for targeting *boro* planting. What also do your results say about the potential for axial flow pump sales by private companies in this area?

f) *Summar*ize data and prepare a graph representing data on surface water irrigation suitability for Tala Upazila.

2) Describe your achievement from the training. Provide your comments and suggestions to make improvement in the *Geospatial Tool*.

**3)** Present your work to the other groups and discuss the ways in which each group has different or similar results.