



Nile Basin Decision Support System

Spreadsheet Manager Training Module

Revision History

Version	Date	Revision Description
0.1	25/5/2014	Initial draft
0.2	22/9/2014	Final draft version
0.3	26/12/2014	Final version for approval

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1. Introduction

This document is part of training modules for the Nile Basin Decision Support System (DSS). These modules are developed for use in classroom training that is given to Nile Basin countries and as self-learning training material that will be made available as part of the DSS helpdesk and knowledgebase.

1.1. Purpose

The purpose of this document is to provide a tutorial on the DSS Spreadsheet Manager. The tutorial starts with the basics and progressively increases in complexity.

1.2. Module pre-requisites

The following prerequisites are needed before taking this tutorial:

Software prerequisites: The Mike by DHI version 2014 and the DSS version 2.0 have to be installed.

User prerequisites: User is expected to be familiar with the DSS user interface basics and DSS Scripts manager.

1.3. Expectations

Upon successful completion of the lessons, exercises and review questions in this document, you will be familiar with most of the Spreadsheet manager functionalities.

1.4. Conventions

The following conventions are followed in this document:



means a tip for the user



means important information

1.5. Module data

The files needed to run this tutorial are located in the ..\ **SpreadsheetExp\Data** folder.

1.6. Links to additional resources

In addition to the information presented in this module, below are links to additional resources that you can access to obtain further information on the following:

- Spreadsheet manager:
 - The DSS help file
- Spreadsheet Gear
 - <http://www.spreadsheetgear.com/>

1.7. Problem Reporting Instructions

This document will be updated regularly. Therefore, it is highly recommended to report any spotted problem to helpdesk@nilebasin.org so it can be corrected in future versions.

When reporting the problem, you are kindly requested to provide the following:

- Document title
- Document version
- Page number where the problem was spotted
- A description of the problem

2. Lessons

In this section the following lessons (with exercises) are included:

- General: This lesson introduces you to the spreadsheet concept and the uses of a spreadsheet followed by an explanation of the DSS Spreadsheet manager and its components. It concludes with a list of the function categories that exist in the DSS with a focus on those functions related to the DSS functionalities.
- Spreadsheet manager basics: This lesson introduces you to basic tasks such as activating the manager, organizing data within the manager, adding a new spreadsheet, using the toolbars and context menu, opening and adding data to a spreadsheet.
- Spreadsheet formatting and visualization: This lesson shows you how data in a spreadsheet can be formatted and visualized.
- Handling changes and metadata: This lesson introduces you to the change log and metadata sections of each spreadsheet. It also shows how they can be used.
- Advanced spreadsheet tasks: This lesson describes how functions can be used in a spreadsheet. It also shows how data can be imported into or exported from a spreadsheet. Finally it explains how scripts can be used within a spreadsheet.

After completing the lessons and exercises in this manual you will be able to use the “Spreadsheet Manager” to manage tabular data within the DSS.

2.1. General

Introduction

This lesson describes some definitions and concepts used in Nile Basin DSS. If you are familiar with those definitions and concepts you can skip this and move to the next lesson.

Topics covered in this lesson:

- What is a spreadsheet? And what are its uses?
- Description of the DSS Spreadsheet manager and its components
- List of the Spreadsheet manager function categories
- A description of the DSS related functions

Lesson objectives:

After completing this lesson, you will be familiar with the following:

- Spreadsheet concepts and uses
- The DSS Spreadsheet manager components and functions

What is a spreadsheet?

A spreadsheet, also known as a worksheet, contains rows and columns and is used to record, compare, and process numerical, logical or text data. Originally, they only existed in paper format, but now they are most likely created and maintained through a software program that displays the numerical information in rows and columns. Figure 1 shows a basic example of what a spreadsheet - in Microsoft Excel - looks like as well as highlighting all the major components of a spreadsheet.

Computerized spreadsheets mimic their paper predecessors. In the software, the intersection of a row and a column is called a cell. Rows are generally identified by numbers — 1, 2, 3, etc. — and columns are identified by letters, such as A, B, C, and so on. The cell label or address is a combination of a letter and a number to identify a particular location within the sheet, such as A3. The advantage of using computer programs is their ability to update data and perform automatic calculations.

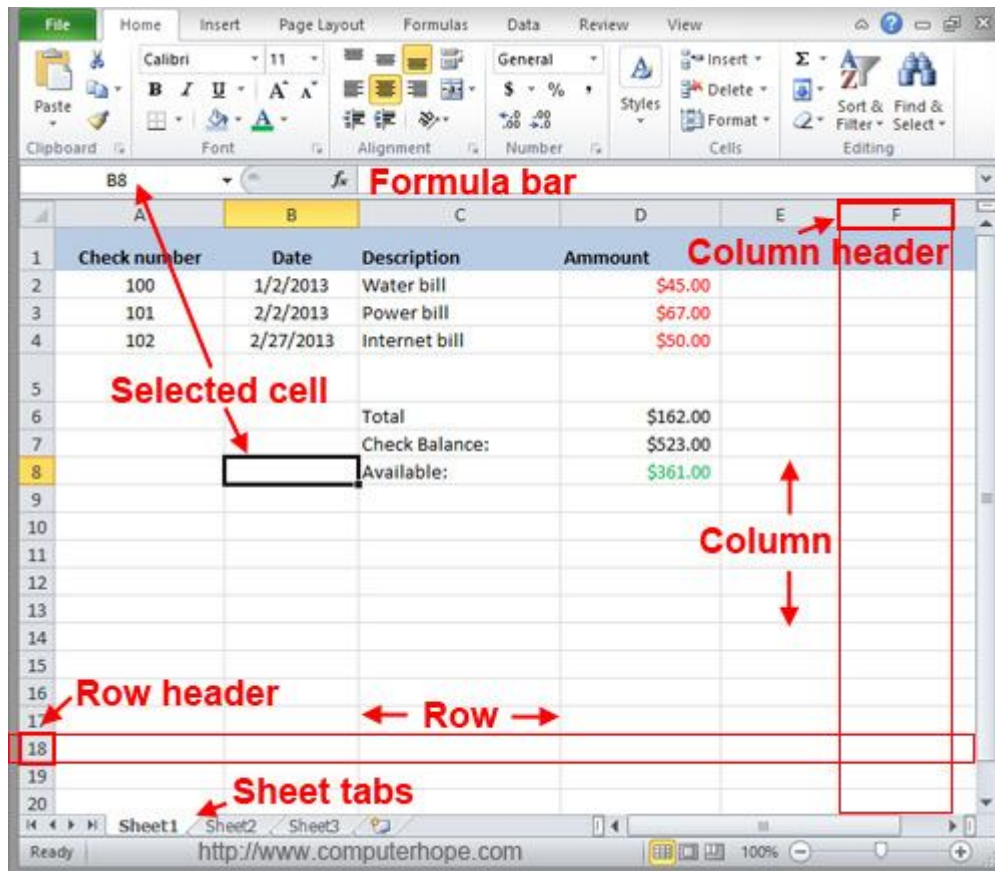


Figure 1: An example of a spreadsheet (Microsoft Excel)

What are the uses of a spreadsheet?

Spreadsheets can be used in any area or field that works with numbers and are commonly found in the accounting, budgeting, sales forecasting, financial analysis, and scientific fields. Teachers can use them to store and average grades, while other individuals can use them to track a personal budget or store sports team statistics. Scientists mostly use spreadsheets for math calculations and some basic database functions and for creating charts of - for example - time series data.

The DSS Spreadsheet Manager

The DSS Spreadsheet manager has a similar look and functions of Microsoft Excel. It is built using a spreadsheet component called 'SpreadsheetGear'¹. The manager's functionality allows you to manipulate data the way it is manipulated in Excel. You have all the options to manipulate the data using the built in functions (See below

¹ See <http://www.spreadsheetgear.com/> for more details.

Spreadsheet manager

for details) and/or functions created under the scripting manager (See Scripts manager training module for details). The processed data can be saved in the DSS database. It can be used for plotting graphs in excel.

Spreadsheets can also be used in the DSS for advanced tasks such as showing indicator values and undertaking multi-criteria and cost benefit analyses.

The DSS Spreadsheet manager components

Figure 2 shows the components of the DSS Spreadsheet Manager, namely:

1. The Spreadsheet Explorer: where spreadsheets are organized in user defined groups and subgroups.
2. The Spreadsheet Window area: where the spreadsheet data is viewed.
3. Tools Explorer: where the tools that are relevant to spreadsheets are accessed.
4. The Properties Window: where the selected spreadsheet or tool properties are displayed, property values are set and selected tools are executed.

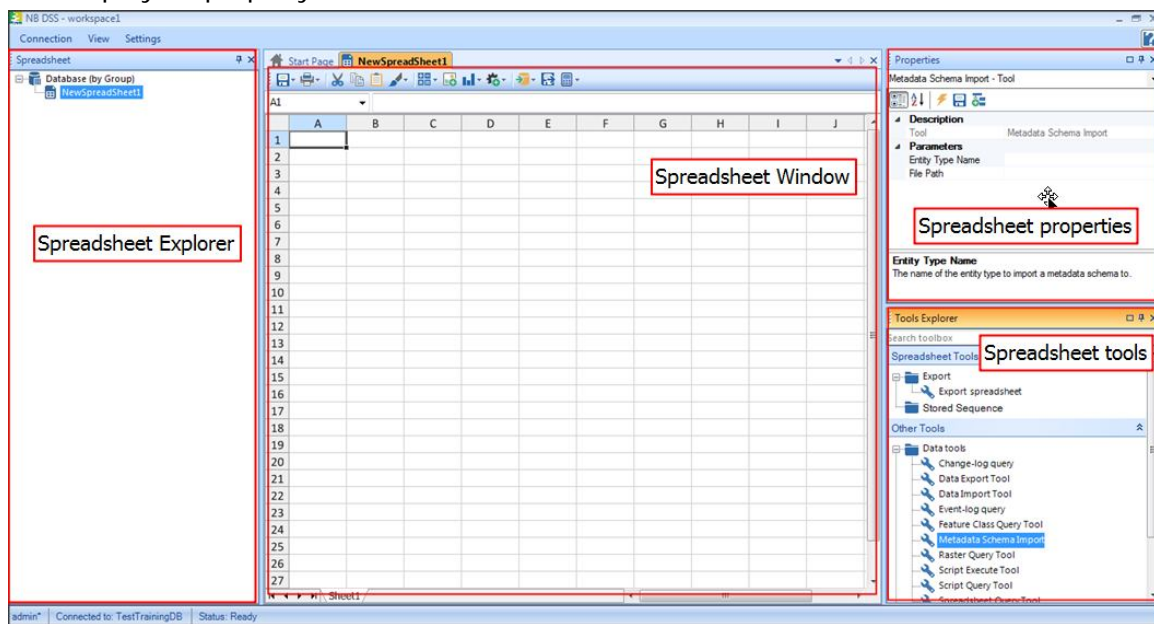


Figure 2: Spreadsheet manager components

The DSS Spreadsheet manager function categories

A number of built in functions are incorporated within the Spreadsheet manager to process, manipulate and analyze data. These functions are categorized as follows:

1. Database and list management.

Spreadsheet manager

2. Date and Time.
3. Financial.
4. Information
5. Logical
6. Lookup and reference
7. Math and trigonometry
8. Statistical
9. Text
10. Analysis toolpak
11. Range
12. GIS
13. Time Series
14. Indicator
15. DSS Scripts

It should be noted that the first 11 categories are similar to the built-in functions that are in Microsoft Excel. For a full list of the functions that exist for each of those categories see <http://www.spreadsheetgear.com/products/spreadsheetgear.net.aspx>. On the contrary, the last 4 categories are related to DSS objects such as GIS features, Time series data, indicators and scripts. These are explained in the next section.

The DSS related functions in Spreadsheet manager

In the following tables, a list of all of the related DSS functions are presented with a description of what they can be used for

Category: GIS	
GetFeatureClass	
CalculateArea	
CalculateLength	

Category: Time Series	
GetTimeseries	Gets the time series by path or optionally subset by date and time

Category: Time Series	
GetTimeseriesQuantile	Gets the time series quantile by path and fraction
TimeseriesMaximumValue	Gets the maximum value in a time series identified by path
TimeseriesAnnualINDayMinimum	
TimeseriesweighedAverageValue	Calculates the time weighed average of a time series identified by path
WithinYearStatistics	
MovingAverageTimeseries	Gets a time series calculated as moving average of the source time series identified by path
TimeseriesMinimumValue	Gets the minimum value in a time series identified by path
TimeseriesExeedance	Calculates the volume of a curve above the specified threshold
DurationCurve	Calculates the duration curve of a time series identified by path

Category: Indicator	
GetIndicator	Gets indicator path and argument

Category: DSS scripts
Under this category, all the scripts that take numerical arguments (e.g. not a time series or model objects) and are stored within the database are listed. These will vary from one database to another.

Review Questions

1. What is a spreadsheet?
2. Give two examples of the spreadsheet uses.
3. list 4 built-in function categories of the spreadsheet manager focusing on DSS added functionality

Spreadsheet manager

4. The financial function category has functions related to the DSS objects (i.e. Time series data).
 - True
 - False

Answers

1. A spreadsheet, also known as a worksheet, contains rows and columns and is used to record, compare and process numerical, logical and text data
2. Teachers can use them to store and average grades. Scientists mostly use spreadsheets for math calculations and some basic database functions and for creating charts of - for example - time series data.
3. The built-in function categories focusing on DSS added functionality are:
 - GIS
 - Time Series
 - Indicator
 - DSS Scripts.
4. False

2.2. Spreadsheet Manager basics

Introduction

This section introduces you to a number of basic tasks that can be undertaken using the Spreadsheet manager.

Topics covered in this lesson:

- Description of the spreadsheet window
- Activating the Spreadsheet manager
- Using tools and context menus of the spreadsheet window
- Adding a new spreadsheet to the Spreadsheet manager
- Opening and adding data to a spreadsheet
- Adding more sheets to a spreadsheet

Lesson objectives:

By the end of this lesson, it is anticipated that you will be able to:

- Activate the Spreadsheet manager.
- Organize data within the Spreadsheet manager
- Use the toolbar and context menus of the spreadsheet window
- Carry out basic spreadsheet tasks such as adding data to a spreadsheet.

Lesson pre-requisites

You have to be familiar with the DSS user interface basics to take this lesson.

Spreadsheet window

As explained in the [general](#) section, the Spreadsheet manager has 4 components. The spreadsheet window is one of these components where data entry, formatting, and visualization are carried out. The view has its own components as shown in Figure 3. The main components are the cells where data is entered. The cells are addressed using a row number and a column heading. The address of the selected cell is always shown in the left side next to the formula bar. The formula bar is where the content of a cell is displayed. To access frequent tasks, a toolbar and context menus are provided.

Spreadsheet manager

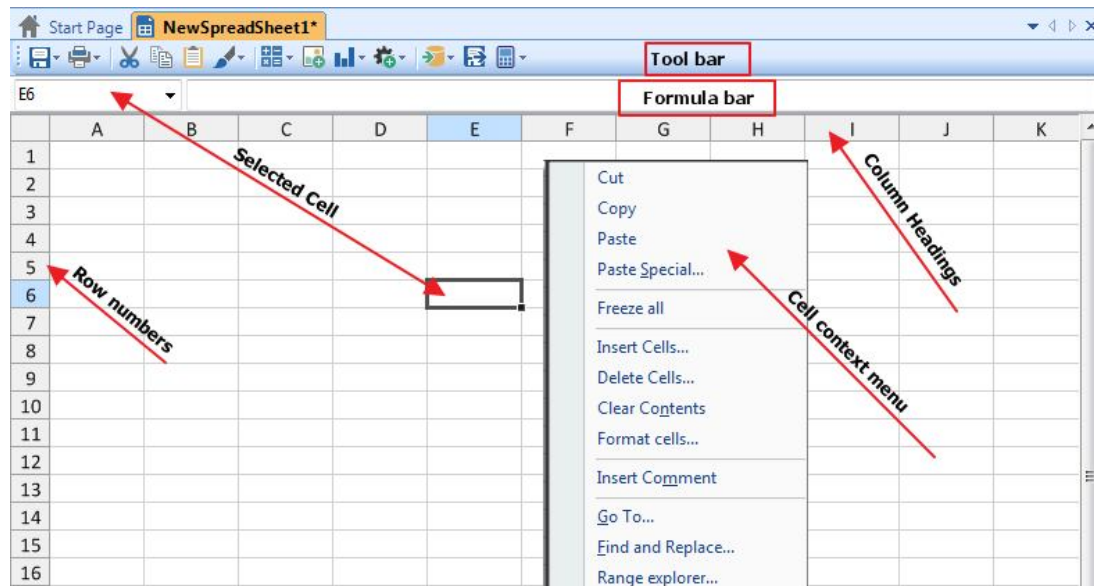














Figure 3: Spreadsheet view components

Spreadsheet toolbar

As can also be seen in Figure 3, the spreadsheet view has a toolbar that helps you undertake frequent tasks (e.g. print and save). The spreadsheet view toolbar allows you to do the following tasks:

-  Print, or preview the print page.
-  Save or save-as the current spreadsheet to the database
-  Cut the selected cells or chart(s) to the clipboard
-  Copy the selected cells or chart(s) to the clipboard
-  Paste clipboard contents
-  Format or clear formatting of cells, rows, columns or sheets.
-  Insert a spreadsheet function into the selected cell
-  Insert an image into the active sheet
-  Insert a chart based on the selected data
-  Insert a control (e.g. a button) that can be linked to data or a script
-  Save selected cells to a time series or update feature attributes in the database
-  Export active sheet to excel

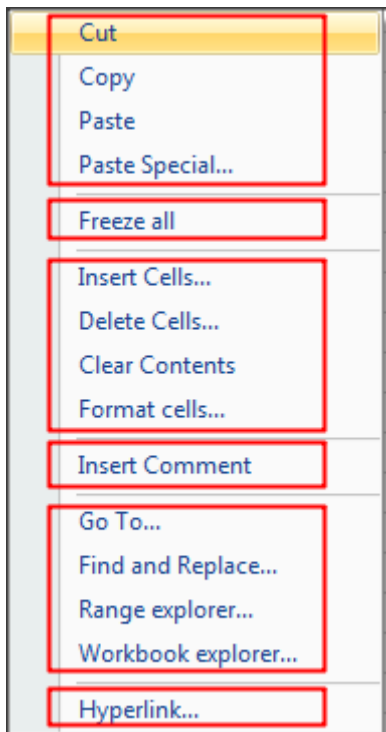


Toggle calculations mode between automatic and manual

Spreadsheet context menus

A number of context menus exist in the Spreadsheet manager. These are activated by right clicking on an object (i.e. a cell) within the spreadsheet view. The two key ones are the cell and the chart context menus. The function of each one is explained below.

The cell context menu



Editing operations such as cut, copy, paste and paste special the content of a cell.

???

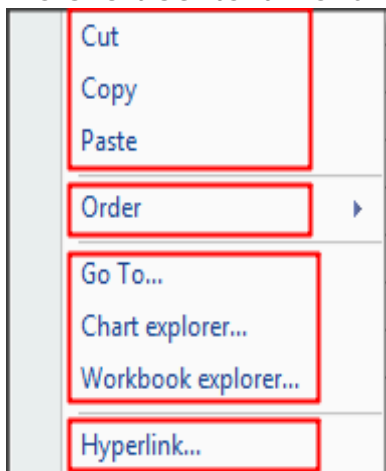
Cell manipulation operations such as adding, deleting, formatting and clear formatting of a cell or a number of cells.

Insert a comment into the selected cell

Various navigation operations such as 'GoTo' (a cell or a reference), 'Find and Replace' text or a formula and explore the properties of a range or the whole worksheet

Insert a hyperlink into the selected cell.

The chart context menu



Editing operations such as cut, copy or paste the selected chart.

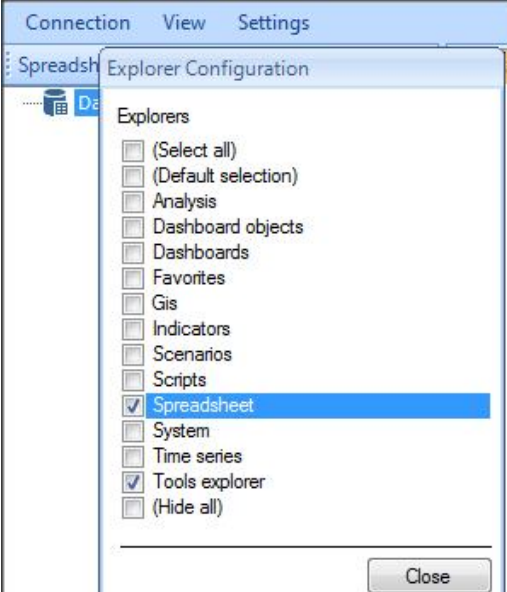
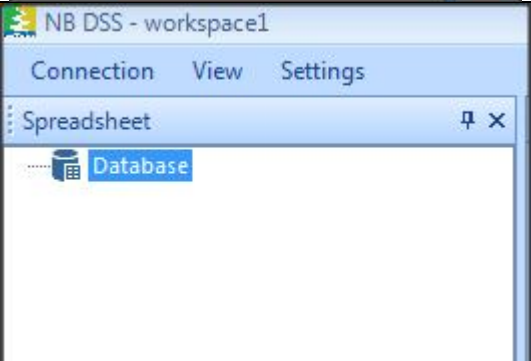
Set the order of the select chart (back or front of the cells)

Various navigation operations such as 'GoTo' (a cell or a reference) and explore the properties of the selected chart or the whole worksheet

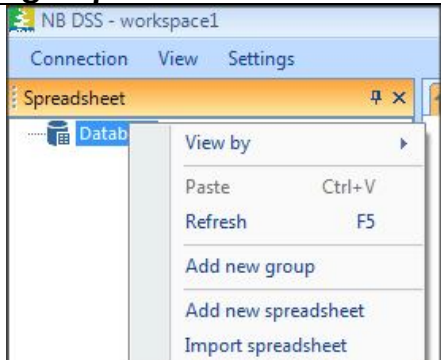
Insert a hyperlink into the selected cell or chart.

Exercises

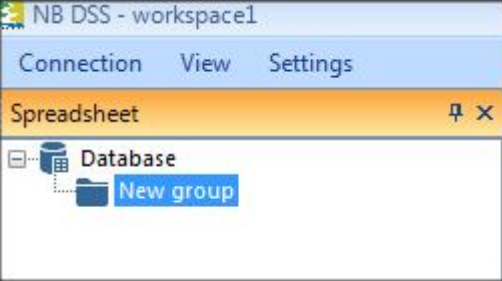
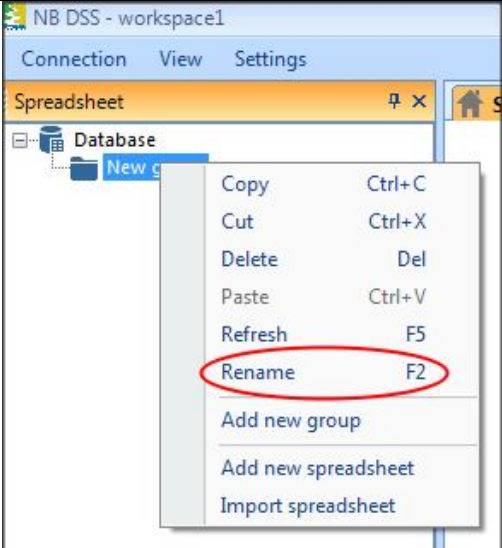

Activating the Spreadsheet manager

<p>1- In the DSS, click on View Menu, click "Explorers..." and the Explorer Configuration box appears. Tick the box next to Spreadsheet and also ensure that the 'Tools explorer' box is ticked to be able to use the time series tools.</p>	
<p>2- Spreadsheet explorer should appear within the DSS window. The explorer has a main group called 'Database'. This main group is created by default when a new DSS database is created. Under this main group you can have 'user defined' groups.</p>	

Adding and renaming a new 'user defined' group

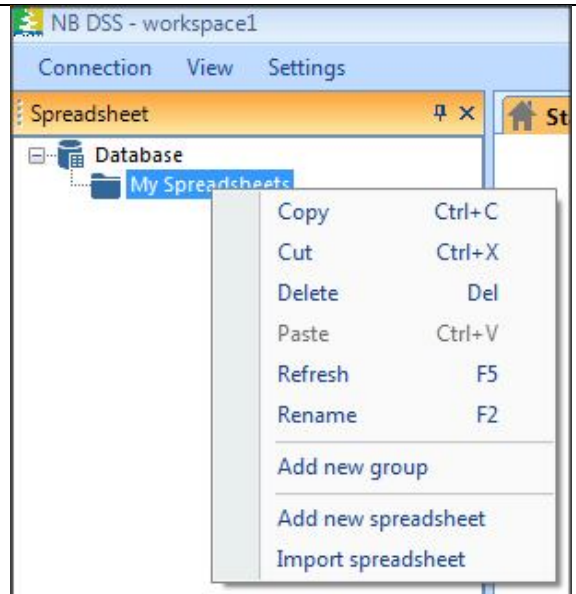
<p>1- Within the Spreadsheet explorer, right click on the 'Database' group.</p>	
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Spreadsheet manager

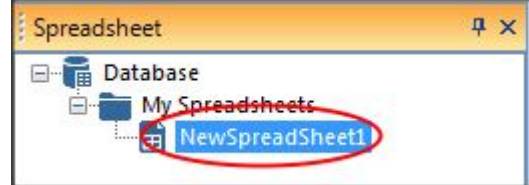
<p>2- Click on the Add new group option. A new group is added as shown next.</p>	 <p>The screenshot shows the 'NB DSS - workspace1' window with tabs for 'Connection', 'View', and 'Settings'. The 'Spreadsheet' tab is active, displaying a tree view under 'Database' with a newly added folder named 'New group'.</p>
<p>3- Select the new group and either right click with the mouse and select Rename or press the keyboard function Key 'F2' to rename it.</p>	 <p>The screenshot shows the same interface as the previous step, but with a right-click context menu open over the 'New group' folder. The 'Rename' option is highlighted with a red circle. Other options in the menu include Copy, Cut, Delete, Paste, Refresh, Add new group, Add new spreadsheet, and Import spreadsheet.</p>
<p>4- Enter a suitable name (e.g. My Spreadsheets).</p>	 <p>The screenshot shows the 'NB DSS - workspace1' window with the 'New group' folder now renamed to 'My Spreadsheets' under the 'Database' folder.</p>

Adding a new Spreadsheet

1- Within the Spreadsheet explorer, right click on either the 'Database' or a group that is under the 'Database' (e.g. My Spreadsheets).

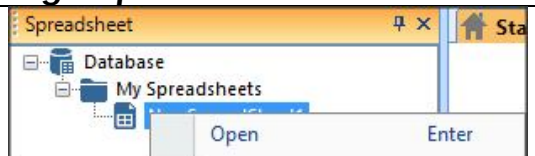


2- Click on the **Add new spreadsheet** option. A new spreadsheet is added as shown next. The new spreadsheet name can also be changed in same way the group name was changed in "Adding and renaming a new 'user defined' group".

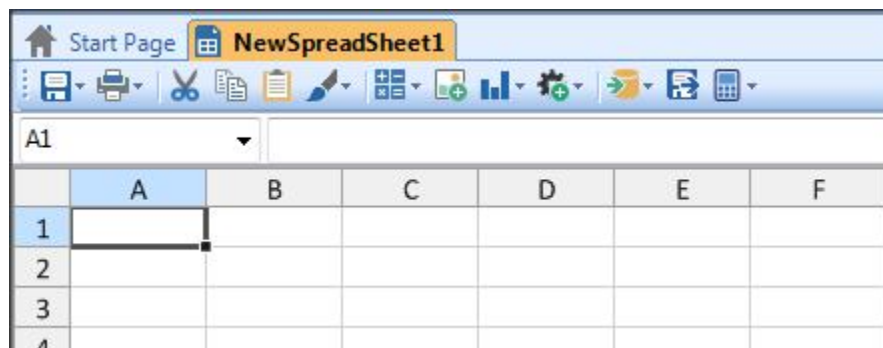


Opening and adding data into and saving a spreadsheet

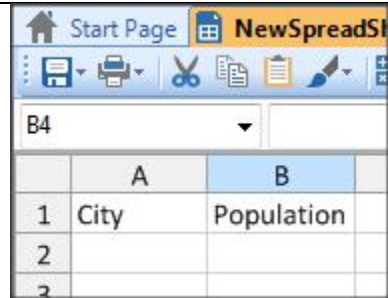
1- To open a spreadsheet, double click on it or right click and then click **Open** on the context menu



2- Once the spreadsheet is opened, it looks like the window shown below – very similar to an excel sheet.




3- Adding data into the spreadsheet can be through selecting a cell and typing in the data. For example, go to cell 'A1' and type 'City' then move to cell 'B1' and type 'Population'.



4- Type in the following data:

City	Population ²
ADDIS ABEBA	2400000
BUJUMBURA	240000
DAR-ES-SALAAM	1100000
KAMPALA	330000
KIGALI	118000
JUBA	56737
NAIROBI	1200000
AL-KHARTUM	930000
AL-QAHIRAH	6800000
Kinshasa	2800000



5- To save the data, click on the  button on the spreadsheet toolbar and then 'Save'. To save the data with another name use the 'Save as' option.

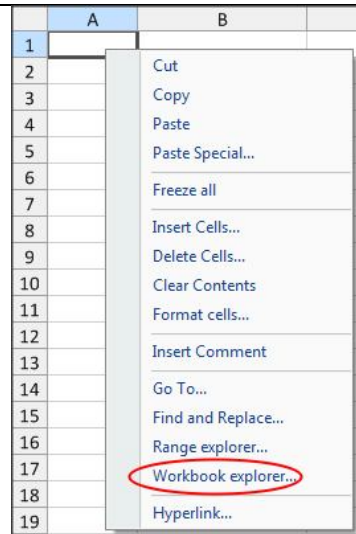


An '*' sign that is shown next to the spreadsheet name means that it has been changed since it was last saved (i.e. it needs to be saved).

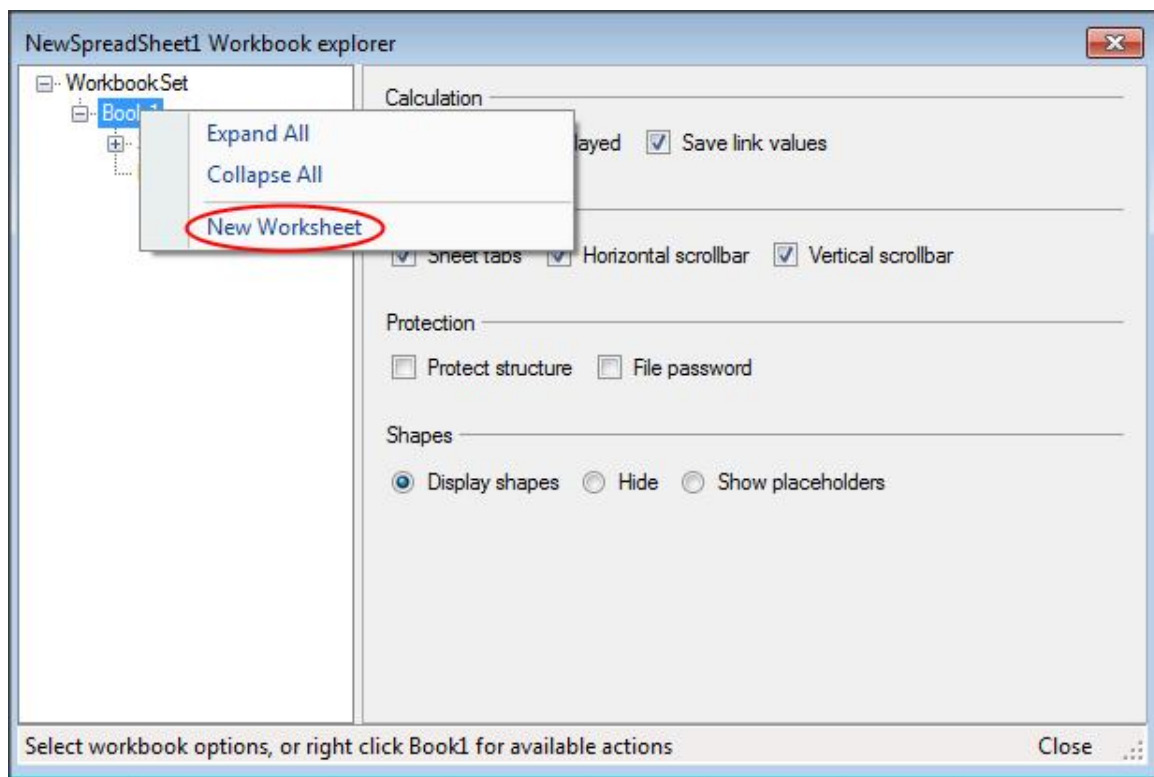
² source: http://www.nationsonline.org/oneworld/capitals_africa.htm

Adding a new sheet into a spreadsheet

1- Open a spreadsheet and right-click a cell and select 'Workbook explorer'

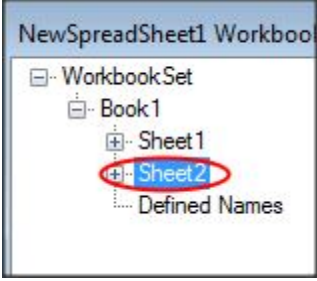


2- Right-click 'Book1' and choose 'New worksheet'



The sheet is added to the spreadsheet.

Spreadsheet manager



The screenshot shows a window titled 'NewSpreadSheet1 Workboo'. Inside, there is a tree view with the following structure:

- WorkbookSet
 - Book1
 - Sheet1
 - Sheet2 (highlighted with a red circle)
 - Defined Names

3- Close 'Workbook explorer'

Review Questions

1. Describe the components of the spreadsheet view.
2. You can insert a chart using the toolbar within the spreadsheet view.
 - True
 - False
3. The chart context menu is used to deal with cell operations.
 - True
 - False

Answers

1. Spreadsheet view components are:
 - Cells.
 - Toolbar
 - Formula bar.
 - Selected cell address or reference.
 - Context menus
2. True.
3. False (Cell context menu)

2.3. Data formatting and visualization

Introduction

This section introduces you to data formatting and visualization within the Spreadsheet manager.

Topics covered in this lesson:

- Formatting data
- Visualizing data in a chart
- Customizing a chart

Lesson objectives:


By the end of this lesson, it is anticipated that you will be able to:

- Format data within the spreadsheet Manager
- Visualize data in a chart
- Customize chart appearance

Lesson pre-requisites

You have to be familiar with spreadsheet manager basics (See the [spreadsheet basics](#) section for details) to take this lesson.

Data formatting and visualization

It is often needed in a spreadsheet program to format and visualize data in a chart. These capabilities are available as part of the DSS Spreadsheet manager. Data entered can be formatted using the 'Range' explorer (See Figure 4) that can be accessed using the toolbar or the cell context menu. The 'Range' explorer offers a wealth of options to deal with various formatting requirements such as number format, cell content alignment, font, borders and interior and conditional formatting which allows you to format a cell based on its value or content. Visualizing data in a chart can also be achieved using the  of the toolbar that allows you to insert a chart of the following types:

- Basic (Column, line , pie, bar or area) charts
- Scatter
- Stock

Spreadsheet manager

- Bubble
- Radar

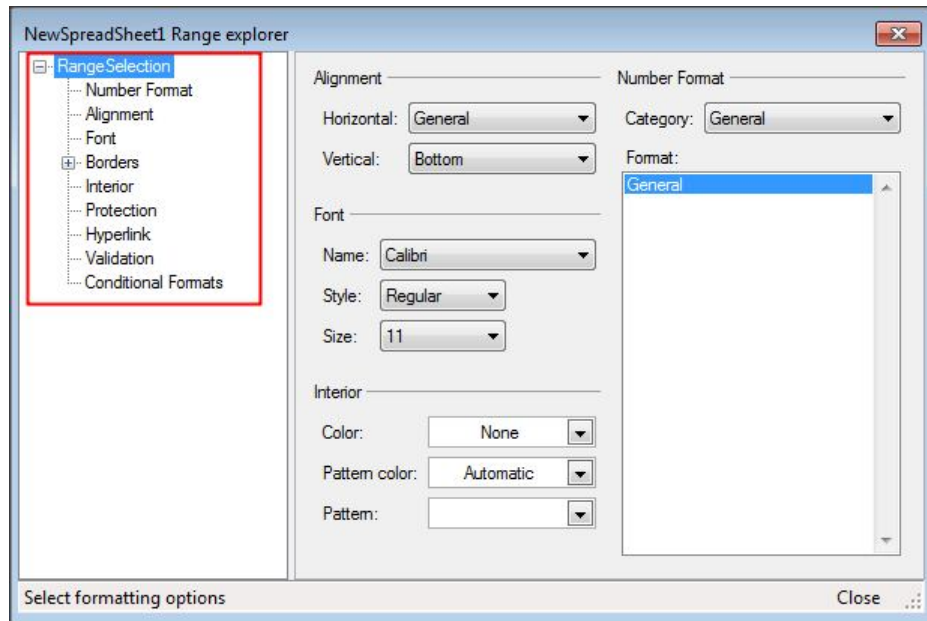


Figure 4: The 'Range' explorer options

The created chart can also be customized using the 'Chart' explorer (See Figure 5). The 'Chart' Explorer also has a wealth of options to deal with various chart formatting requirements such as formatting chart and plot areas, legend, Titles and axes.

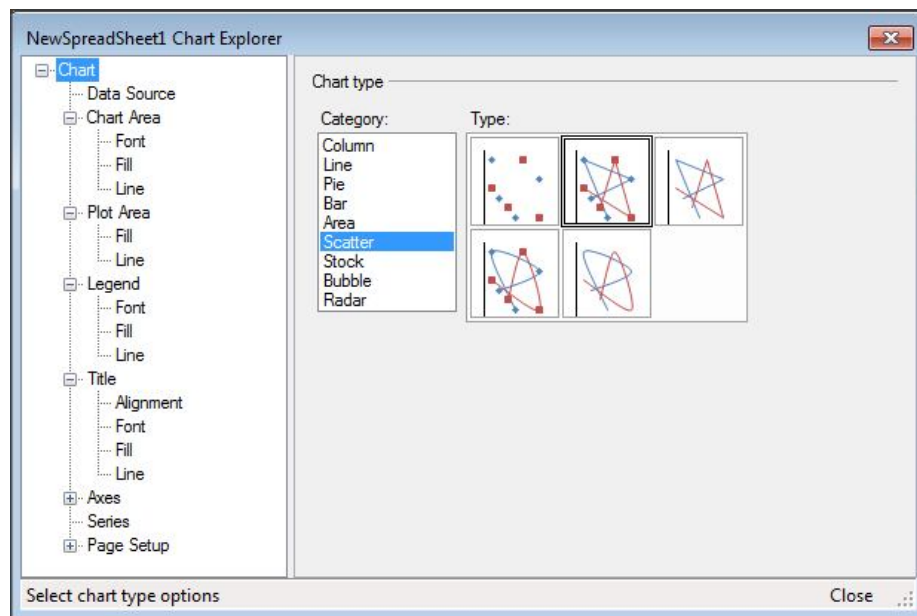

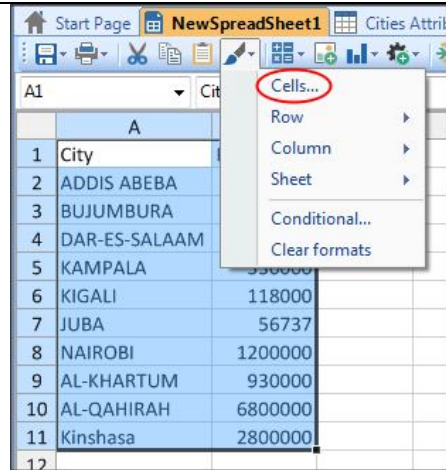


Figure 5: The 'Chart' explorer options

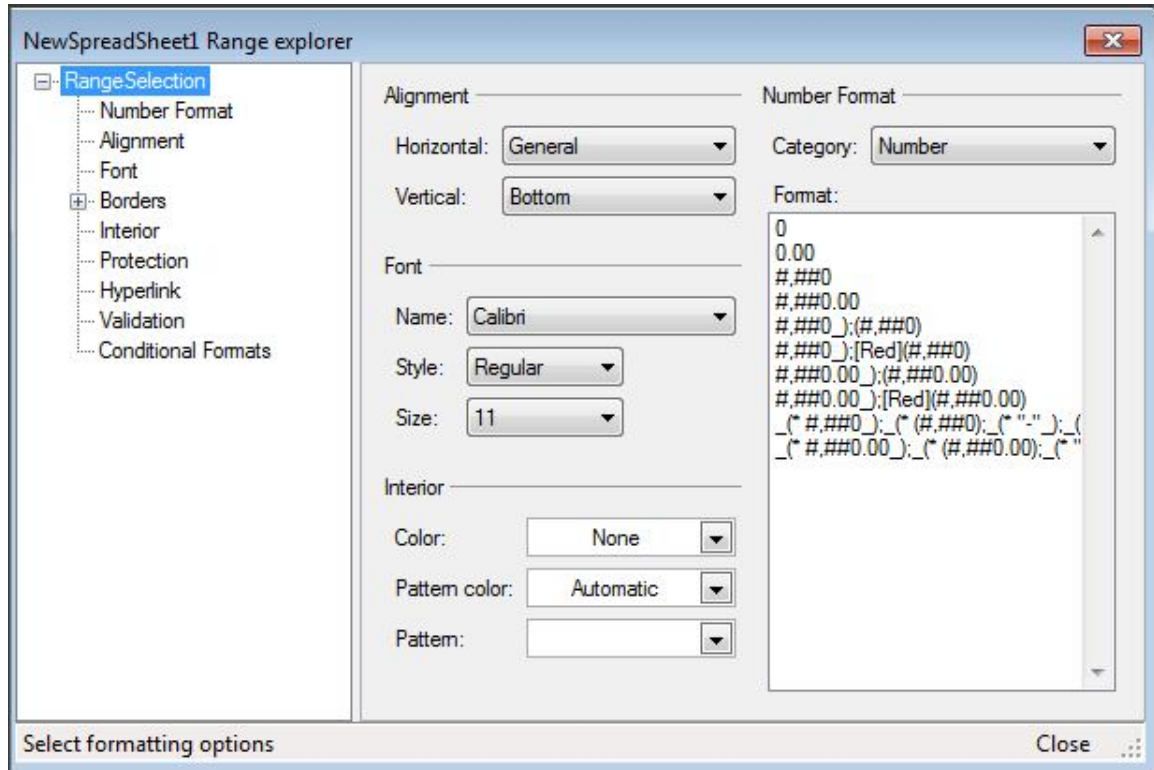
Exercises

Formatting spreadsheet cells

1- To format a number of cells in the Spreadsheet Explorer, Select them and click the  button on the spreadsheet toolbar and then 'Cells'.



2- This opens the 'Range explorer'.



'Range explorer' helps you to change:

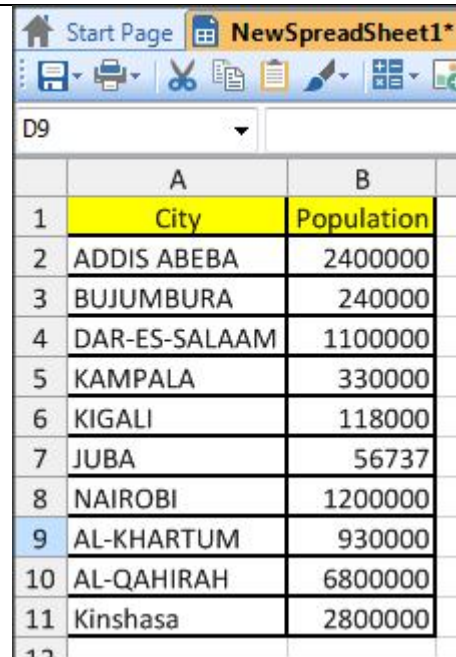
- Cell number format
- Cell content alignment
- Cell content font size, style and color
- Cell border
- Cell background color and pattern (i.e. cell Interior)

The 'Range explorer' can also be used to add a hyperlink, validation criteria (e.g. limit input into a cell to a certain number range) or protection (e.g. make a cell read only) to a cell.

- 3- In this example you are going to:
- Add borders to all cells
 - Change the interior of the first row to 'Yellow'
 - Change the Alignment of the first row to 'Center'.


You are encouraged to do this based on the explanation given above.

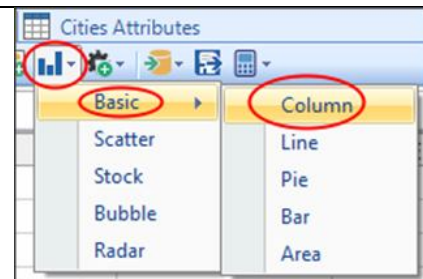
Table should look like the widows shown next.



	A	B
1	City	Population
2	ADDIS ABEBA	2400000
3	BUJUMBURA	240000
4	DAR-ES-SALAAM	1100000
5	KAMPALA	330000
6	KIGALI	118000
7	JUBA	56737
8	NAIROBI	1200000
9	AL-KHARTUM	930000
10	AL-QAHIRAH	6800000
11	Kinshasa	2800000

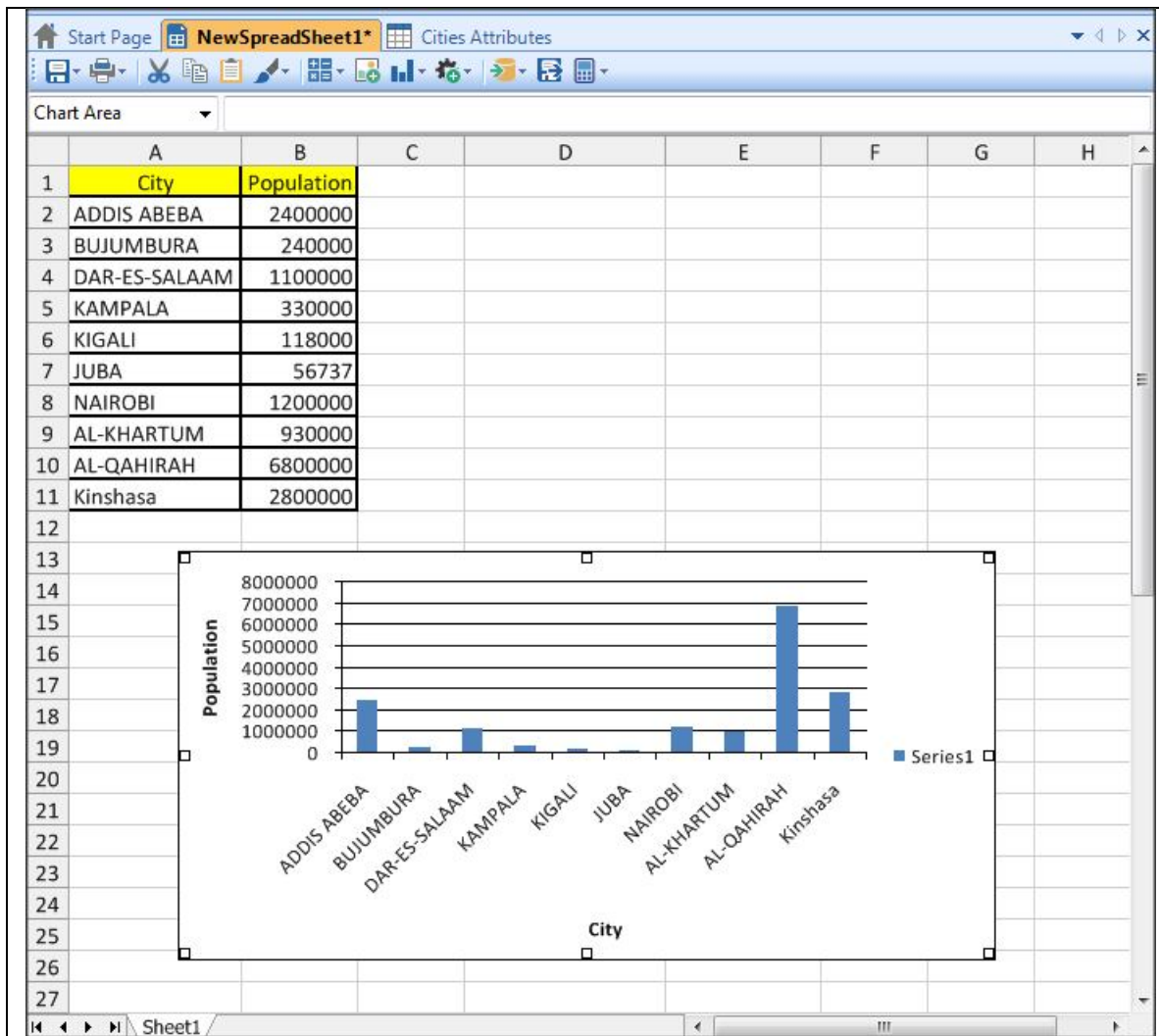
Visualizing data in a chart

1. To display your data in a chart, first select the 'City' and 'Population' data (Header and data from Cell A1 to Cell B11). Following this, click on the  button on the spreadsheet toolbar and then insert a 'Column' chart as shown next.



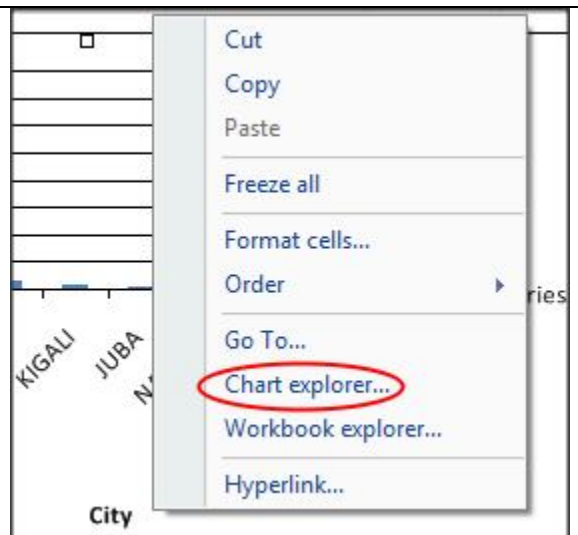
- 2- A chart is inserted as shown below with the horizontal axis showing the cities and the vertical axis showing the population.

Spreadsheet manager



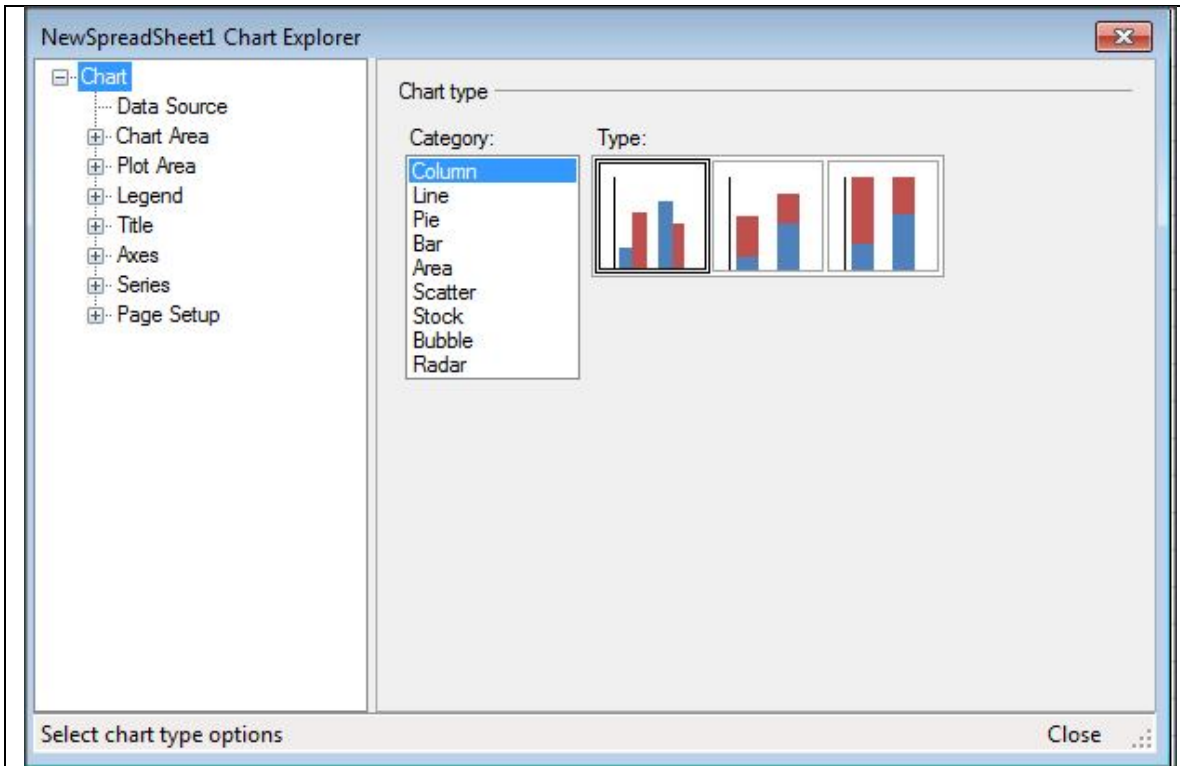
Customizing a chart

1- The chart created in the above exercise can be improved by right clicking with the mouse and modify its properties using the 'Chart Explorer'



2- The 'Chart explorer' can be used to modify the following chart items:

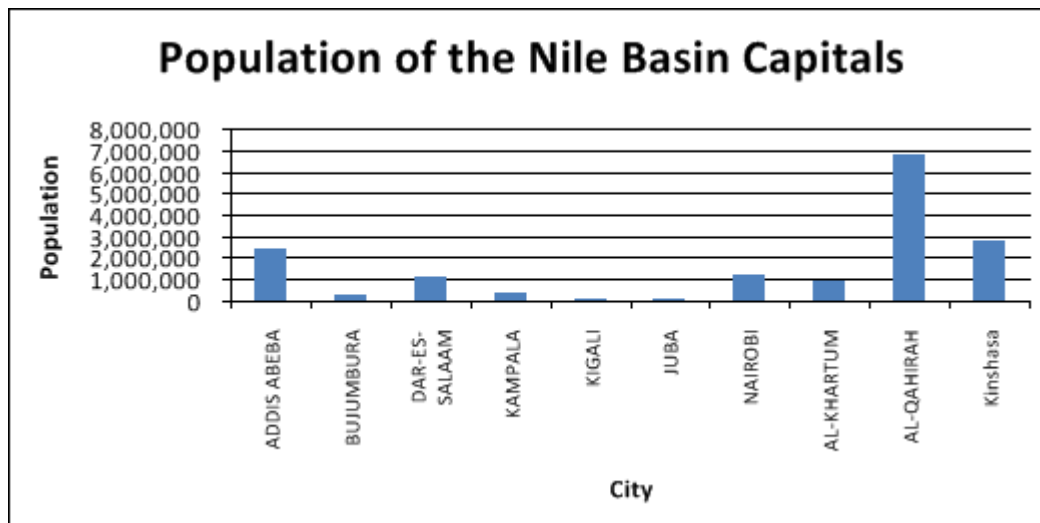
- Chart: You can change the chart type.
- Data source: is the data that is used in the chart
- Chart Area: is the area that is outside the plot area. You can change the text font, background (fill) color and the border color and type.
- Plot Area: is the area where the data is plotted. You can change the background (fill) color and the border color and type.
- Legend: is the area where each series name, color and marker (if any) are shown. You can change the legend text font, background (fill) color and the border color and type.
- Title: is the chart title. You can add a title to a chart and also change its alignment, text font, background (fill) color and the border color and type.
- Axes: The properties of the horizontal and vertical axes can be changed here. These properties include axis title alignment, text font, color, border, and major and minor gridlines.
- Series: here the properties that belong to a series can be changed (rather than all of them). These properties include chart type, data source, color and border type. A trend line can also be added to the data (if applicable).
- Page Setup: You can setup the print area for the chart using this option (e.g. margins, header and footer).



3- in this example, the following chart properties will be modified to improve the chart:

- Change the Horizontal-axis alignment to 90 degrees and the font size to 8.
- Change the Vertical-axis Number to 'Number' category and select the ' #,##0 ' format.
- Add a chart title (e.g. 'Population of the Nile Basin Capitals').
- Remove the legend.

The chart should look like the one shown below.



You are encouraged to try the rest of the 'Chart explorer' options.

Review Questions

- 1- List three formatting options that are available in the 'Range' Explorer.
- 2- List three formatting options that are available in the 'Chart' Explorer.
- 3- 3D charts are not available in the Spreadsheet manager.
 - True
 - False

Answers

- 1- Number format, cell content alignment, font, borders and interior and conditional formatting.
- 2- Formatting chart and plot areas, legend, Titles and axes.
- 3- True (All chart types are 2D).

2.4. Handling changes and metadata

Introduction

This lesson introduces you to the handling of spreadsheet changes and metadata within the DSS.

Topics covered in this lesson:

- Examining the change log entries for a spreadsheet
- Importing and editing a spreadsheet metadata

Lesson objective:

After completing this lesson, you will be able to:

- Understand the change log entries for each spreadsheet
- Handle spreadsheet metadata

Lesson pre-requisites

You have to be familiar with spreadsheet manager basics (See the [spreadsheet basics](#) section for details) to take this lesson.

Spreadsheet changes and metadata

One of the main challenges to data users is to keep a log of the changes made to a data set and also save and keep its metadata updated. The DSS solves this problem through an innovative solution. When a spreadsheet is added to the Spreadsheet manager, The DSS monitors all operations that is carried out on it noting the time and date of this operation, and who carried it out. For example, when a spreadsheet is added, an entry is added to the 'Change log' of this it to show the time and date of adding this spreadsheet and also a description of the operation as shown in the below figure.

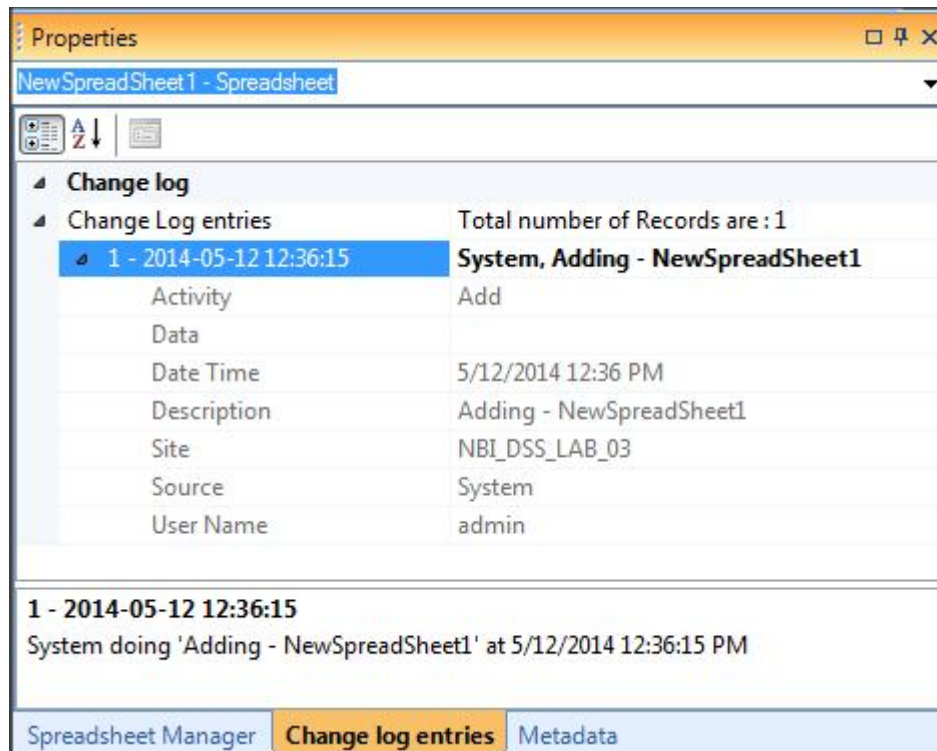


Figure 6: Change log example

Similarly, the DSS allows you to import spreadsheet metadata through an xml schema. Once this schema is within the DSS, it is saved and linked to all spreadsheets where the metadata can be entered and updated as needed.

To define the metadata properties an agreement on a common set of metadata properties to be used has to be made. At a technical level the metadata properties must be expressed as an XML schema. An example of a simple schema is

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema attributeFormDefault="unqualified" elementFormDefault="qualified"
xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="metadata" > <!--Root node -->
<xs:complexType>
<xs:sequence>
<xs:element name="identification" minOccurs="0" > <!--Category -->
<xs:complexType>
<xs:sequence>
<xs:element name="originator" type="xs:string" minOccurs="0" />
<xs:element name="publicationdate" type="xs:dateTime" minOccurs="0" />
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>
```

The above simple schema defines one property, `identification`, which is optional (i.e. `minOccurs=0`) and consists of two (also optional) values, `originator` and `publicationdate`. The first is a string, while the latter is a date-time. Data types of properties in such a schema should be kept to standard types as defined by <http://www.w3.org/2001/XMLSchema>

Note in addition to 'string' and 'datetime' data types, 'decimal' types are also used. You are encouraged to read more about the xml schema in the 'Data Quality Assurance Guideline: Data Processing, Quality Assurance and Metadata' report that was published as part of the 'Data Compilation and Pilot Application of the Nile Basin Decision Support System (NB-DSS)' study (Work Package 2: Stage 2).

Free software is available and can help create/edit XML schemas. One example of such software is XMLFox which can be downloaded from <http://www.xmlfox.com/>. It shows the schema as a tree (Figure 7) and allows easy editing. It creates the XML tags automatically.

Spreadsheet manager

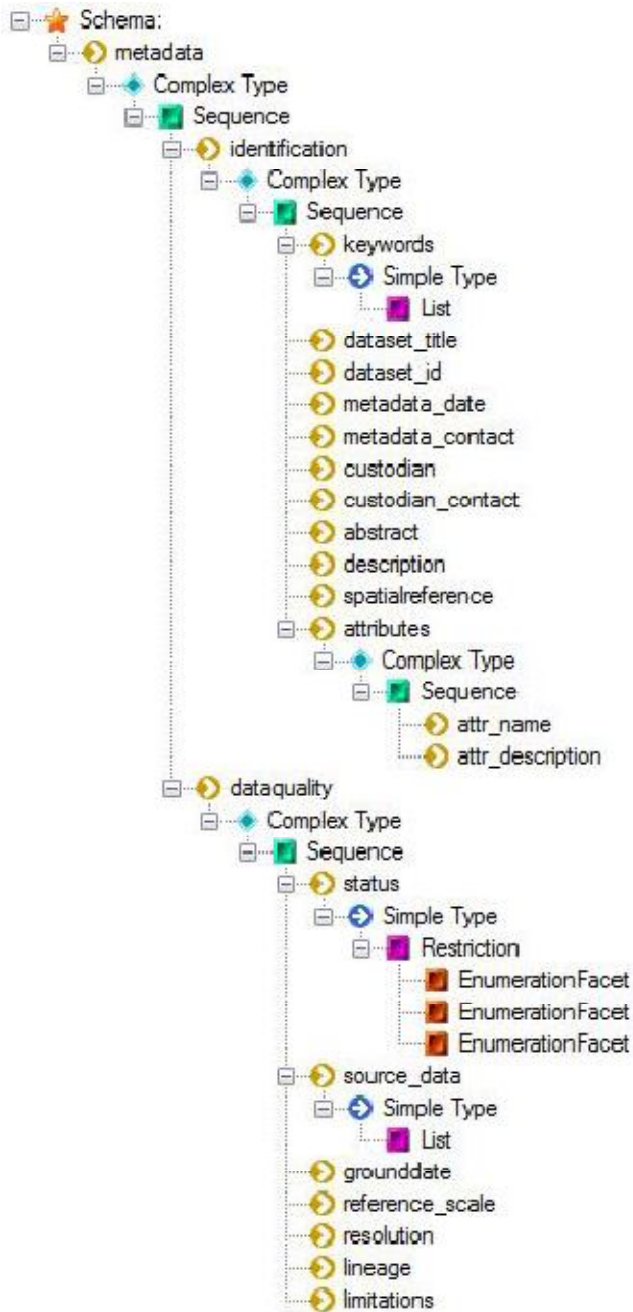
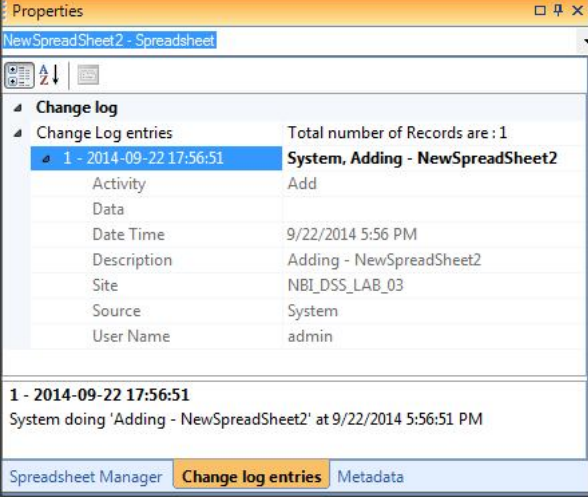
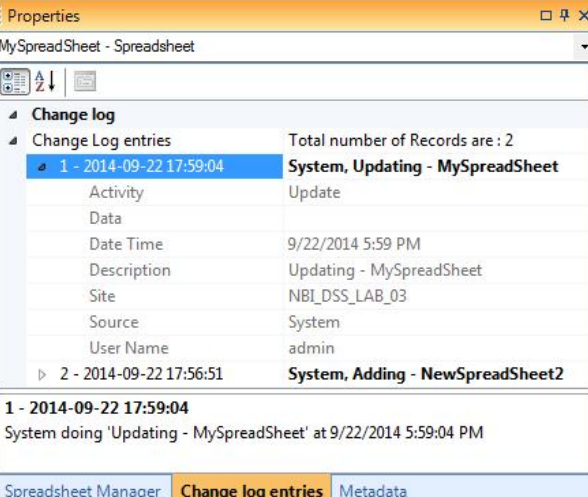


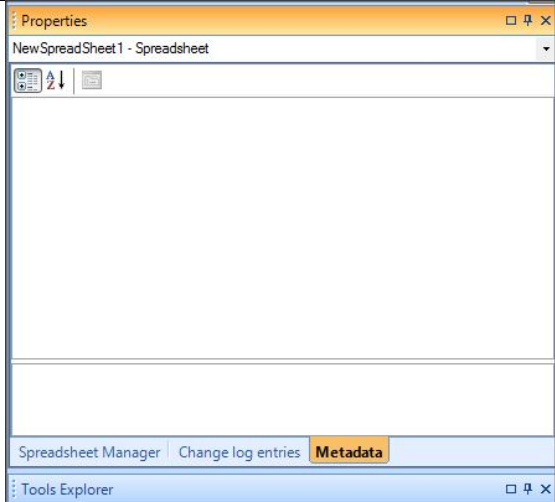
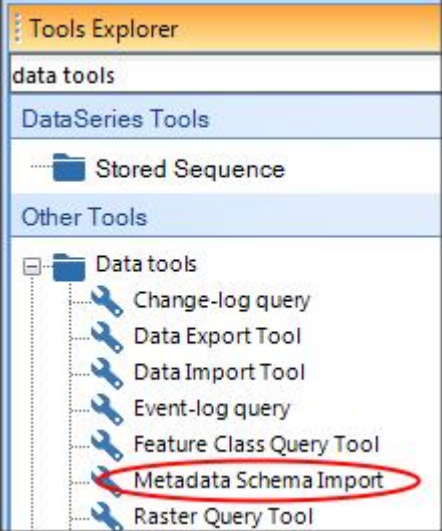
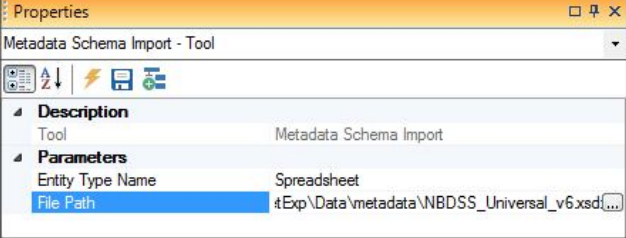
Figure 7: NB DSS Universal Metadata Schema in XMLFox


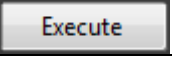
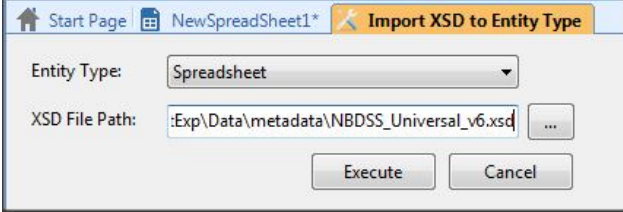
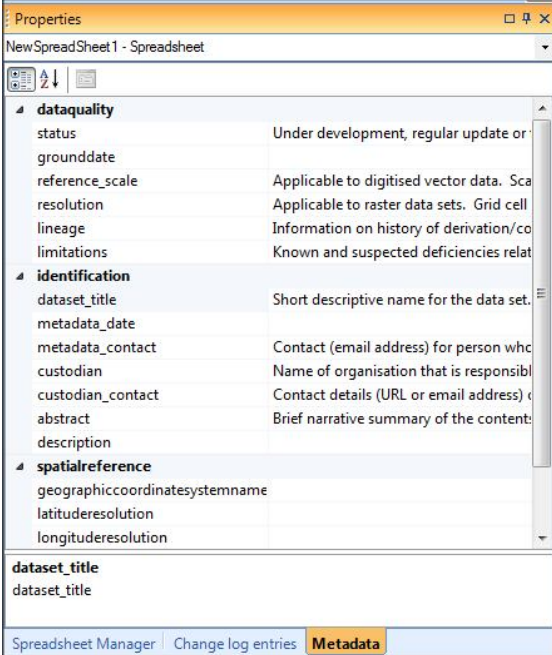
Exercises

Handling spreadsheet change Log

<p>1- Add a spreadsheet into the Spreadsheet manager (See adding a new Spreadsheet section for details).</p>	
<p>2- In the Properties Windows, select the 'Change log entries' tab. You will notice that there is one entry in the change log. The entry shows that the spreadsheet was added to the database. Double click the entry to expand (or alternatively click the little arrow to the left of the entry). You can see more details such as the activity type, date and time and user who carried out the activity.</p>	
<p>3- Rename the spreadsheet and check the again the 'Change log entries' tab.</p> <p>What did you notice? Write down your observations. (Hint: compare what you see against the next figure).</p> <p>Note that entries are ordered from the most recent to the oldest.</p>	

Handling spreadsheet metadata

<p>1- Switch to the third tab of the properties window called 'Metadata' for the spreadsheet created in the previous exercise. For this spreadsheet no metadata exists.</p>	
<p>2- If metadata fields do not exist, a schema needs to be imported using the 'Metadata Schema Import' tool under the 'Data tools' category. To use the tool, select 'Metadata Schema Import' from the 'Data tools' category.</p>	
<p>3- Once the tool is selected, its properties appear in the 'Properties' window. Two parameters need to be entered for this tool. The first is the DSS entity type to which the template should be applied (i.e. spreadsheet in this case) and the second is the 'File Path' to the metadata schema file. Select the 'NBDSS_Universal_v6.xsd' file that is located in the '..\SpreadsheetExp\Data\metadata'</p>	

folder.	
5- Click the  button. The next dialog box appears. Confirm that both entity type and XSD file path are correct and then click the  button.	
6- The metadata schema is imported and loaded into the 'Meta data' tab. Select a spreadsheet and go to the metadata tab to familiarize yourself with the content, the template contains descriptions of the various fields. You can start entering metadata for any spreadsheet.	

Review Questions

1. Explain how spreadsheet metadata schema is imported and updated in the DSS.
2. The DSS keeps track of all the operations made on a spreadsheet.
 - True
 - False
3. When a spreadsheet metadata schema is imported into the DSS, can this schema be made available for time series data?
 - True
 - False

Answers

1. The DSS allows the users to import spreadsheet metadata schema through an xml schema using the 'Metadata Schema Import' tool. Once this schema is within the DSS, it is saved and linked to the spreadsheet. Metadata can also be updated directly by the users if needed.
2. True.
3. False. A specific entity type is specified for each metadata schema at the time it is imported into the DSS database.

2.5. Advanced Spreadsheet tasks

Introduction

This lesson introduces you to some advanced tasks that you can do within the Spreadsheet manager.

Topics covered in this lesson:

- Using built-in functions.
- Importing and exporting data
- Using scripts in a spreadsheet

Lesson objectives:

At the end of this lesson, you will be able to


- Use functions and scripts within a spreadsheet
- Import and export spreadsheets

Lesson pre-requisites

You have to be familiar with the Spreadsheet Manager basics and using scripts to take this lesson.

Using built-in functions

If you are familiar with the built in functions of excel, you will know how beneficial they are in carrying out basic and complex calculations. The Spreadsheet manager offers similar functions (See [the function categories](#) section for details) and in addition DSS related functions (See [the DSS related functions](#) section for details).

The functions are used in the same way as in excel. They can be added from the toolbar using the  icon which shows a number of frequently used functions such as 'Sum', 'Average', 'Count', Max and 'Min'. It also offers a list of all of the available functions by clicking the 'More functions' option (See Figure 8) which displays all functions that you can select and use (See Figure 9).

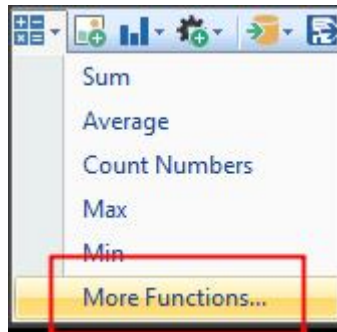


Figure 8: Functions menu

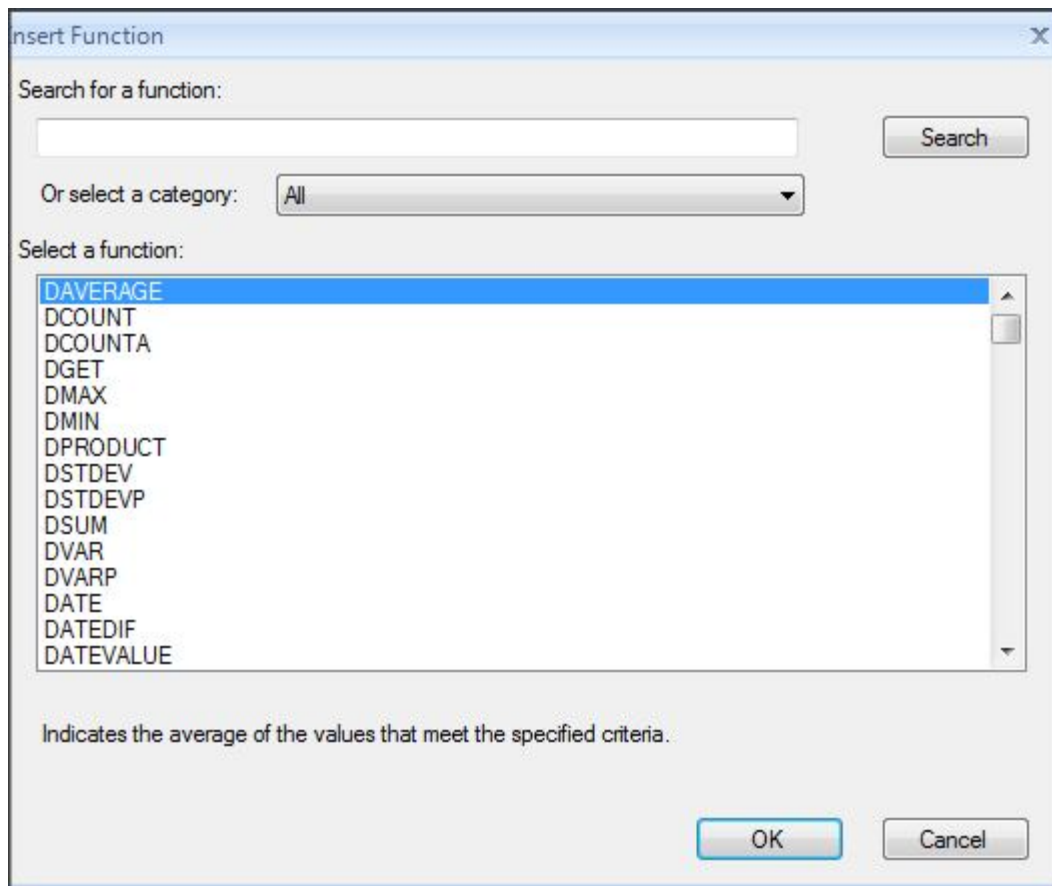


Figure 9: Functions list

Functions can be added by typing an '=' sign followed by the function name as shown in Figure 10. The spreadsheet lists the available functions once a letter is typed after the '=' sign with a floating short description box.

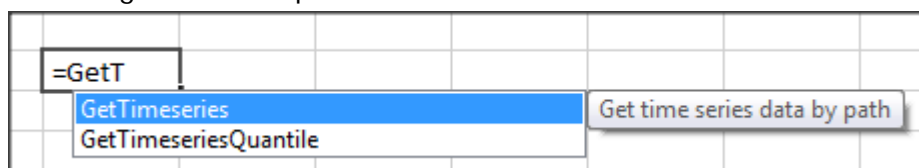


Figure 10: Typing function name in a cell

Importing and exporting data

It is a common task in spreadsheet programs to import and export data. The Spreadsheet manager is no exception as it offers the same functionality. Data can be imported into a spreadsheet either directly from the DSS database or from an excel file. Data can also be exported into an Excel format. This is all done seamlessly within the DSS user interface. The processes of importing and exporting data are explained in detail in the exercises section below.

Using scripts in a spreadsheet

If you are familiar with 'macros' in Microsoft Excel, their equivalent in the DSS is called 'Scripts'. They both help in automating common repetitive tasks. Scripts in the DSS are created in the Scripts manager (See Scripts manager training module for details). Scripts can be called in similar way to functions by typing the '=' sign followed by the script name as shown in Figure 11. For scripts to be called in that way its arguments have to be numeric.

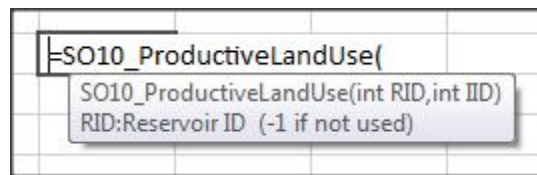


Figure 11: Calling a script as a function

A script can be also associated with a button and is called when this button is clicked as shown in Figure 12. Association is done using the properties window of the button.

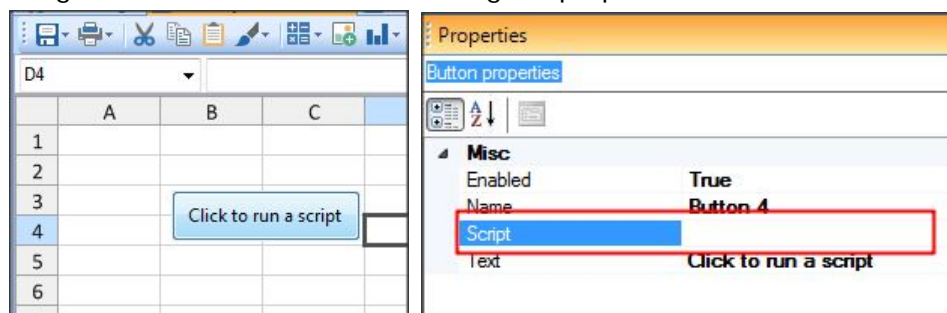

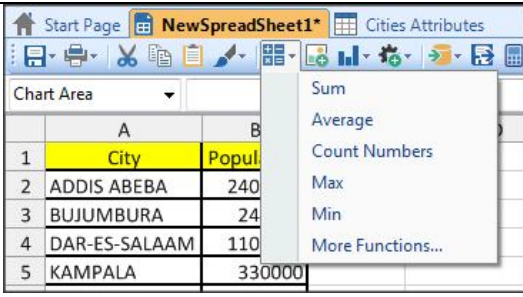
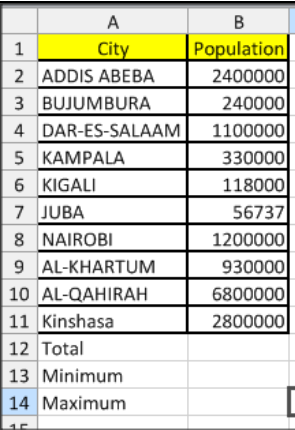

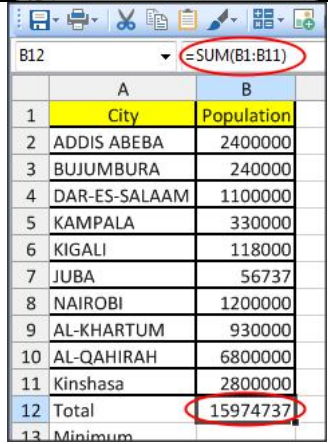
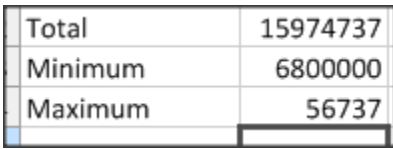


Figure 12: Associating a button to a script

Exercises

Using built-in functions in a spreadsheet

<p>1- The Spreadsheet explorer has a number of functions that can be used to simplify repetitive calculations or tasks. To access these functions click the  button on the spreadsheet toolbar.</p>	
<p>2- Add the following to the City-Population table as shown:</p> <ul style="list-style-type: none"> - Total - Minimum - Maximum 	
<p>3- Go to cell 'B12' and click on the  button and then 'Sum'. Note that the sum has been calculated and the value appears in the cell 'B12'. The formula appears on the bar below the spreadsheet toolbar (=sum(B1:B11)). The function automatically takes the above cells and sums them. Correct the formula by pressing the Keyboard function key 'F2' and make it (=sum(B2:B11)).</p>	
<p>4- Repeat step 3 to calculate the 'Minimum' and 'Maximum' population and have their values in Cells B13 and B14. Examine the formula for</p>	


each function and make necessary changes to correct the automatically picked range.

Values should be as shown next.

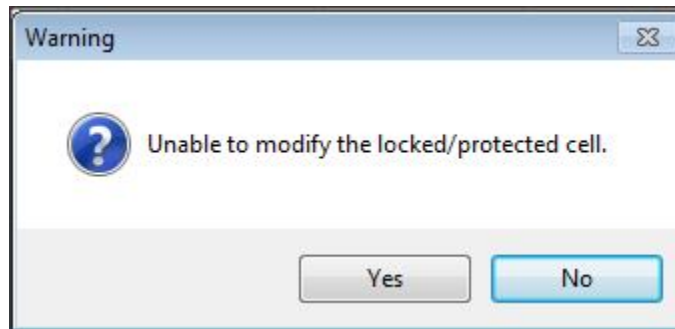


Typing the equal sign in a cell followed by the first letter of a function shows a list of all functions that start with this letter. You then can select the function by double clicking.



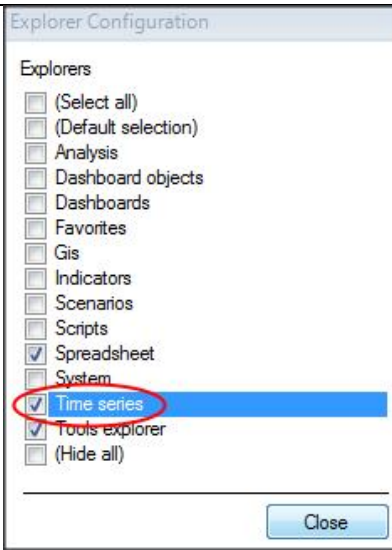
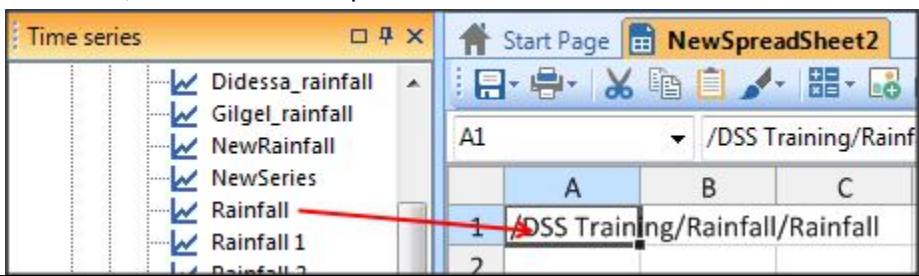
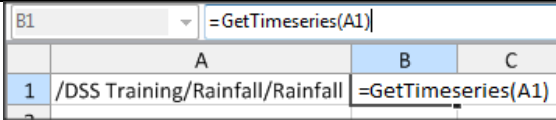
More functions can be accessed by clicking the [More Functions](#) item in the  menu. Help on those functions can be obtained from the DSS help file.

When I tried to use the more functions option I received the following message.



I am not sure if I have made a mistake or this is an issue that needs to be reported to DHI.

Importing time series data

<p>1- Add a new spreadsheet and open it as explained in adding a new Spreadsheet section.</p>	
<p>2- Activate the Time Series explorer as explained activating the Spreadsheet manager section but selecting 'Time Series' from the view menu.</p>	
<p>3- Locate a time series in 'Time Series' explorer (e.g. 'Rainfall') and drag it on to cell 'A1' or alternatively you could use 'copy full path' from the time series context menu and then paste it in the cell (Note that the full path of the time series is entered into the cell).</p>	
<p>4- Move to cell 'B1' and type the formula '=GetTimeseries(A1)' and press Enter.</p>	
<p>5- The data from the time series is loaded into the spreadsheet as shown below.</p>	

	A	B	C
1	/DSS Training/Rainfall/Rainfall	Time	Data Values for Rainfall [mm]
2		1/1/1951 0:00:00	0
3		2/1/1951 0:00:00	0
4		3/1/1951 0:00:00	0
5		4/1/1951 0:00:00	0
6		5/1/1951 0:00:00	0
7		6/1/1951 0:00:00	0
8		7/1/1951 0:00:00	0
9		8/1/1951 0:00:00	0
10		9/1/1951 0:00:00	0
11		10/1/1951 0:00:00	0
12		11/1/1951 0:00:00	0
13		12/1/1951 0:00:00	0
14		1/1/1952 0:00:00	

6- Save the spreadsheet and close it. Now Modify the 'Rainfall' time series data – change a couple of values to something significant (See Editing time series section in the Time Series manager training module for help on this).

Time	Rainfall [mm]
1/1/1951 12:00:00 AM	99
2/1/1951 12:00:00 AM	99
3/1/1951 12:00:00 AM	99
4/1/1951 12:00:00 AM	99
5/1/1951 12:00:00 AM	0
6/1/1951 12:00:00 AM	0
7/1/1951 12:00:00 AM	0
8/1/1951 12:00:00 AM	0
9/1/1951 12:00:00 AM	0
10/1/1951 12:00:00 AM	0
11/1/1951 12:00:00 AM	0
12/1/1951 12:00:00 AM	0
1/1/1952 12:00:00 AM	

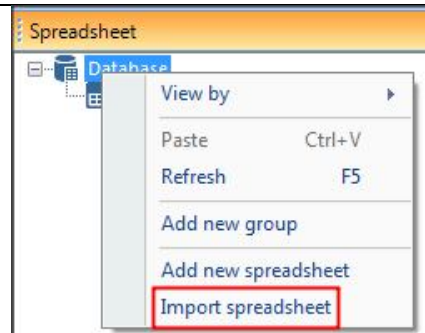
7- Reopen the spreadsheet. Do you see any changes?

B	C
Time	Data Values for Rainfall [mm]
1/1/1951 0:00:00	99
2/1/1951 0:00:00	99
3/1/1951 0:00:00	99
4/1/1951 0:00:00	99
5/1/1951 0:00:00	0
6/1/1951 0:00:00	0
7/1/1951 0:00:00	0

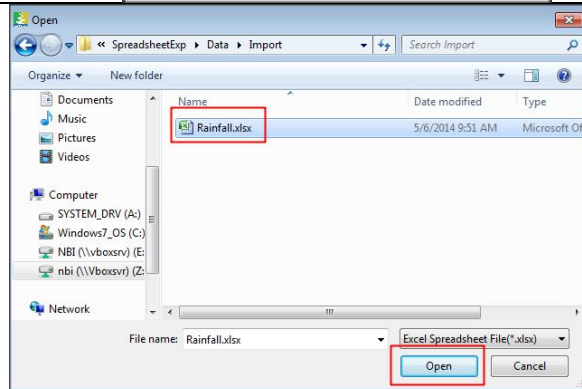
Using the 'GetTimeseries' function establishes a dynamic link between the data and the spreadsheet. This means whenever, that data changes in the time series, it is updated in the spreadsheet when it is re-opened.

Importing a spreadsheet

1- Right click on the 'Database' group or a 'user defined' group and select **Import spreadsheet**



2- Navigate to the **..\SpreadsheetExp\Data\Import** folder and select the 'Rainfall.xlsx' file then click **Open**.



3- The spreadsheet is imported under the 'Database' group

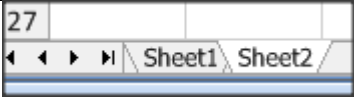

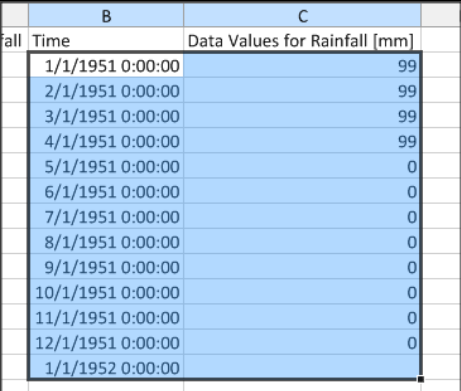

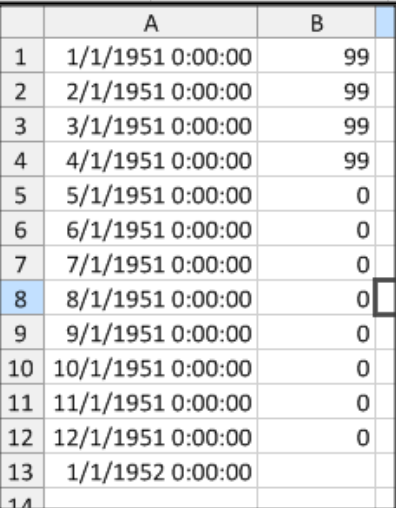




4- Open the spreadsheet to confirm that the contents were imported correctly.

The screenshot shows an Excel spreadsheet titled 'Rainfall'. The data is organized into two columns: A and B. Column A contains dates and times, and Column B contains precipitation rates and accumulated values.


	A	B
1		Precipitation Rate[mm/h]:Mean_Step_Accumulated
2		Rainfall 3
3	1/1/1980 0:00	
4	1/2/1980 0:00	0
5	1/3/1980 0:00	0
6	1/4/1980 0:00	0.138
7	1/5/1980 0:00	0
8	1/6/1980 0:00	0
9	1/7/1980 0:00	0
10	1/8/1980 0:00	0

Exporting spreadsheet data to the database

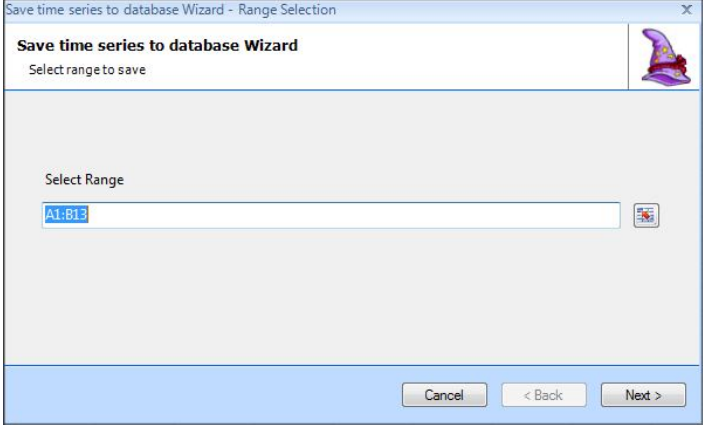
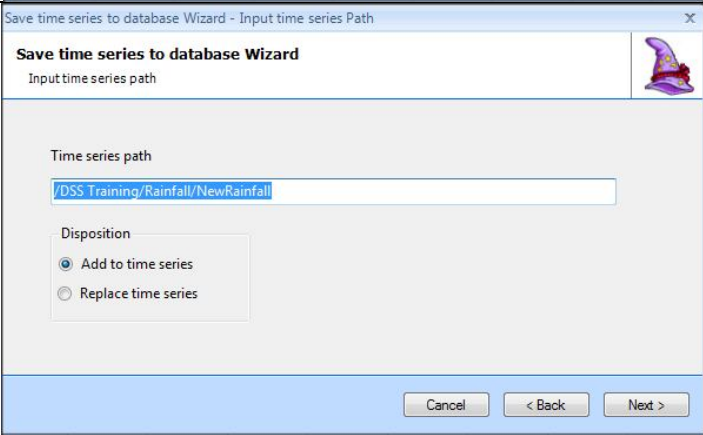
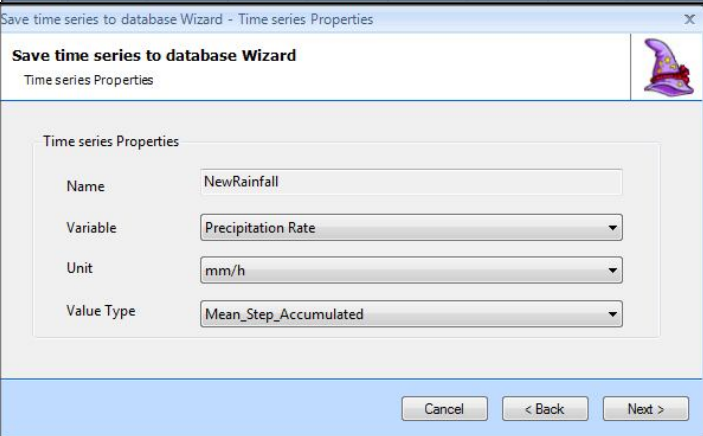
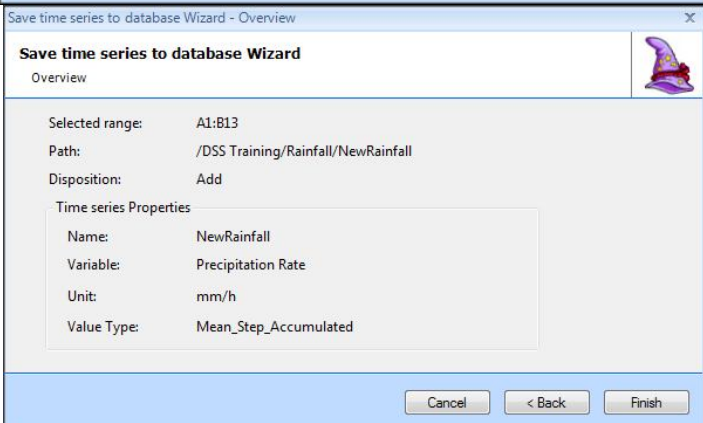
<p>1- Open the 'NewSpreadSheet2' spread sheet and add a new sheet as explained in adding a new sheet into a spreadsheet section.</p>																																														
<p>2- Select 'Sheet1' and copy the rainfall data using the  button on the spreadsheet toolbar</p>	 <table border="1"> <thead> <tr> <th></th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>all</td> <td>Time</td> <td>Data Values for Rainfall [mm]</td> </tr> <tr><td></td><td>1/1/1951 0:00:00</td><td>99</td></tr> <tr><td></td><td>2/1/1951 0:00:00</td><td>99</td></tr> <tr><td></td><td>3/1/1951 0:00:00</td><td>99</td></tr> <tr><td></td><td>4/1/1951 0:00:00</td><td>99</td></tr> <tr><td></td><td>5/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>6/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>7/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>8/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>9/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>10/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>11/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>12/1/1951 0:00:00</td><td>0</td></tr> <tr><td></td><td>1/1/1952 0:00:00</td><td></td></tr> </tbody> </table>		B	C	all	Time	Data Values for Rainfall [mm]		1/1/1951 0:00:00	99		2/1/1951 0:00:00	99		3/1/1951 0:00:00	99		4/1/1951 0:00:00	99		5/1/1951 0:00:00	0		6/1/1951 0:00:00	0		7/1/1951 0:00:00	0		8/1/1951 0:00:00	0		9/1/1951 0:00:00	0		10/1/1951 0:00:00	0		11/1/1951 0:00:00	0		12/1/1951 0:00:00	0		1/1/1952 0:00:00	
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<p>3- Move to 'Sheet2' and paste the data using the  button on the spreadsheet toolbar.</p>	 <table border="1"> <thead> <tr> <th></th> <th>A</th> <th>B</th> </tr> </thead> <tbody> <tr><td>1</td><td>1/1/1951 0:00:00</td><td>99</td></tr> <tr><td>2</td><td>2/1/1951 0:00:00</td><td>99</td></tr> <tr><td>3</td><td>3/1/1951 0:00:00</td><td>99</td></tr> <tr><td>4</td><td>4/1/1951 0:00:00</td><td>99</td></tr> <tr><td>5</td><td>5/1/1951 0:00:00</td><td>0</td></tr> <tr><td>6</td><td>6/1/1951 0:00:00</td><td>0</td></tr> <tr><td>7</td><td>7/1/1951 0:00:00</td><td>0</td></tr> <tr><td>8</td><td>8/1/1951 0:00:00</td><td>0</td></tr> <tr><td>9</td><td>9/1/1951 0:00:00</td><td>0</td></tr> <tr><td>10</td><td>10/1/1951 0:00:00</td><td>0</td></tr> <tr><td>11</td><td>11/1/1951 0:00:00</td><td>0</td></tr> <tr><td>12</td><td>12/1/1951 0:00:00</td><td>0</td></tr> <tr><td>13</td><td>1/1/1952 0:00:00</td><td></td></tr> <tr><td>14</td><td></td><td></td></tr> </tbody> </table>		A	B	1	1/1/1951 0:00:00	99	2	2/1/1951 0:00:00	99	3	3/1/1951 0:00:00	99	4	4/1/1951 0:00:00	99	5	5/1/1951 0:00:00	0	6	6/1/1951 0:00:00	0	7	7/1/1951 0:00:00	0	8	8/1/1951 0:00:00	0	9	9/1/1951 0:00:00	0	10	10/1/1951 0:00:00	0	11	11/1/1951 0:00:00	0	12	12/1/1951 0:00:00	0	13	1/1/1952 0:00:00		14		
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<div style="display: flex; align-items: center;">  <div style="border: 1px solid black; padding: 10px; flex-grow: 1;"> <p>The  button on the spreadsheet toolbar, can be used to cut the data.</p> </div> </div>																																														

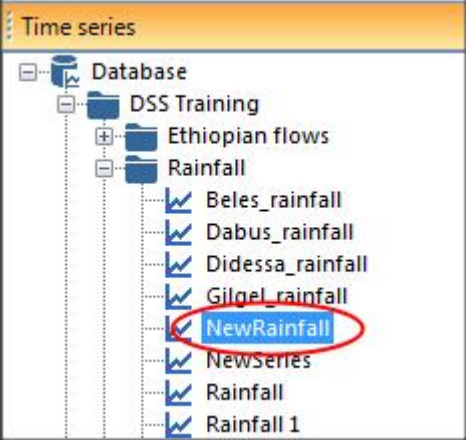


4- Modify the data in Column 'B' as shown.

	A	B
1	1/1/1951 0:00:00	3
2	2/1/1951 0:00:00	5
3	3/1/1951 0:00:00	6
4	4/1/1951 0:00:00	12
5	5/1/1951 0:00:00	20
6	6/1/1951 0:00:00	30
7	7/1/1951 0:00:00	15
8	8/1/1951 0:00:00	12
9	9/1/1951 0:00:00	6
10	10/1/1951 0:00:00	4
11	11/1/1951 0:00:00	2
12	12/1/1951 0:00:00	0
13	1/1/1952 0:00:00	
14		

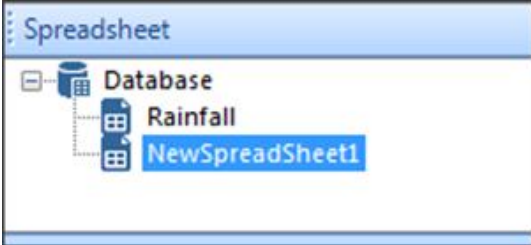
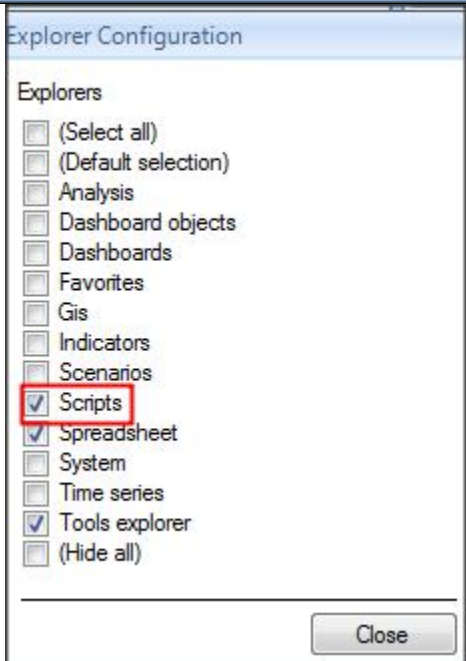
5- Select the data as shown below and press the  button then select [Save Time Series to Database](#) to export the selected data to a time series object.

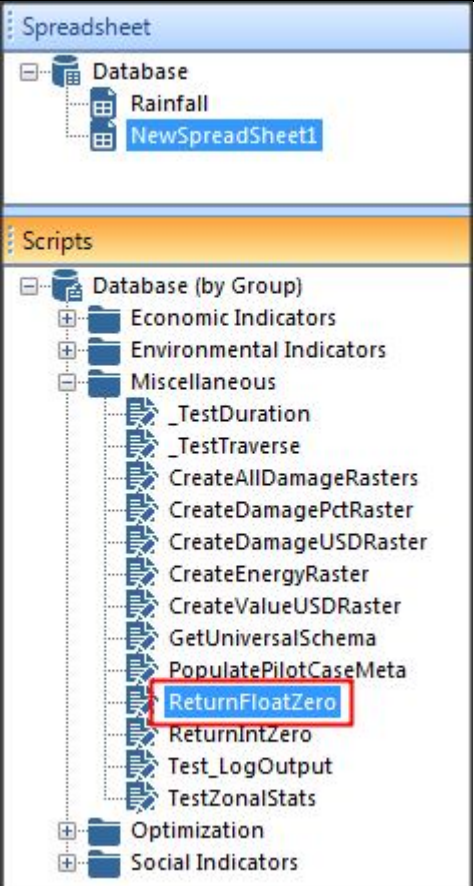
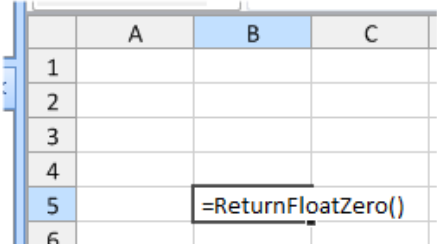
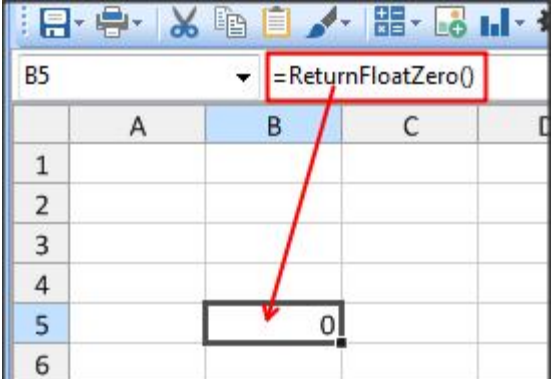
Start Page NewSpreadSheet2*					
A1 1/1/1951 0:00					
	A	B	C	D	
1	1/1/1951 0:00:00	3			
2	2/1/1951 0:00:00	5			
3	3/1/1951 0:00:00	6			
4	4/1/1951 0:00:00	12			
5	5/1/1951 0:00:00	20			
6	6/1/1951 0:00:00	30			
7	7/1/1951 0:00:00	15			
8	8/1/1951 0:00:00	12			
9	9/1/1951 0:00:00	6			
10	10/1/1951 0:00:00	4			
11	11/1/1951 0:00:00	2			
12	12/1/1951 0:00:00	0			
13	1/1/1952 0:00:00				
14					

<p>6- The export wizard appears. Check that the data range is correct and press 'Next'</p>	
<p>7- Enter the path to the time series (e.g. /DSS Training/Rainfall/NewRainfall) and select the 'Add to time series' option and click 'Next'.</p>	
<p>8- Accept the time series defaults and click 'Next'</p>	
<p>9- Check that all input are correct and click 'Finish'.</p>	

<p>10- The time series is now added to the 'Time Series' explorer.</p>	
<div style="display: flex; align-items: center;">  <div> <p>The spreadsheet data can also be exported to an excel sheet by clicking on the  button on the spreadsheet toolbar or through the context menu in the explorer</p> </div> </div>	

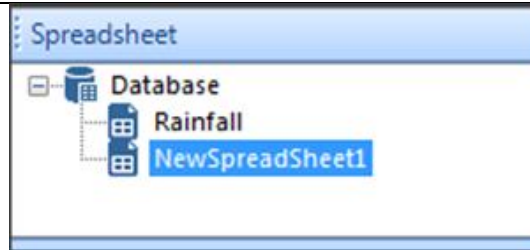
Using a script as a spreadsheet function


<p>1- Add a new spreadsheet and open it as explained in the adding a new Spreadsheet section.</p>	
<p>2- Activate the 'Scripts' explorer as explained in activating the Spreadsheet manager section but selecting 'Scripts' from the explorer configuration list.</p>	

<p>3- Use a simple script that returns a zero value (ReturnFloatZero) to demonstrate the use of a script as a function.</p>	 <p>The screenshot shows the 'Scripts' pane in ArcGIS Desktop. Under the 'Database (by Group)' section, the 'Miscellaneous' group is expanded, and the 'ReturnFloatZero' script is highlighted with a red box. Other scripts visible include '_TestDuration', '_TestTraverse', 'CreateAllDamageRasters', 'CreateDamagePctRaster', 'CreateDamageUSDRaster', 'CreateEnergyRaster', 'CreateValueUSDRaster', 'GetUniversalSchema', 'PopulatePilotCaseMeta', 'ReturnIntZero', 'Test_LogOutput', and 'TestZonalStats'.</p>
<p>4- Type the '=' sign in a cell and the 'ReturnFloatZero()' as shown next. Press 'Enter'</p>	 <p>The screenshot shows an Excel spreadsheet with columns A, B, and C, and rows 1 through 6. In cell B5, the formula '=ReturnFloatZero()' is entered.</p>
<p>5- Note that a value of zero is now in the cell. Look at the formula in the 'Formula bar'. It is the script name that you entered in step 4.</p>	 <p>The screenshot shows the same Excel spreadsheet as in step 4, but now cell B5 contains the value '0'. A red arrow points from the formula bar, which still shows '=ReturnFloatZero()', to cell B5.</p>

Using a script with a button

1- Add a new spreadsheet and open it as explained in [adding a new Spreadsheet](#) section.



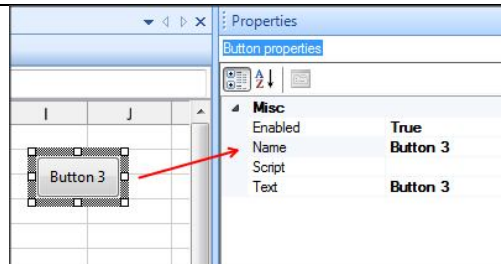
2- The  button on the spreadsheet toolbar can be used to insert controls (e.g. a button) into the current spreadsheet. When this button is inserted into the spreadsheet, it can be linked to a script which runs when the button is clicked.

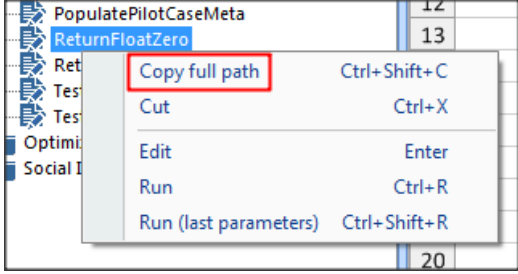
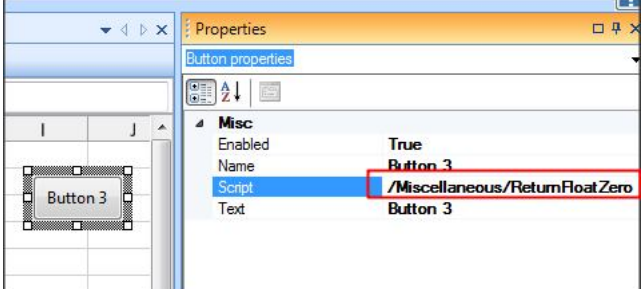
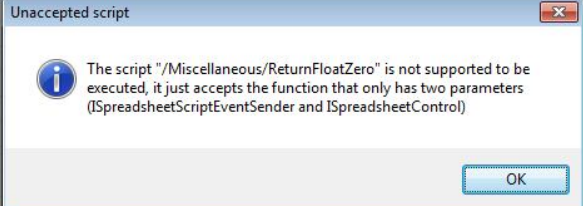


For the remaining controls (e.g. listbox), you can write a script in the script manager to manipulate their contents, actions and behavior but this topic is not covered in this training module.

3- Once the button is inserted, its properties appear in the 'Properties' window. These properties are:

- Enabled: which means that the button can be used
- Name: This shows the name of the button. This name is used when the button is used in a script.
- Script: Here the name of the associated script is entered
- Text: This is the text that appears on the button.



<p>4- The same script that was used in the previous exercise will be associated here with a button to demonstrate the use of a script with a button in spreadsheet. Therefore, go to the 'Scripts' manager and right click the 'ReturnFloatZero' script and copy its full path to use as the script name in the button properties.</p>	
<p>5- Paste the full path in the button properties window as shown next.</p>	
<p>6- I received the following error</p>	

Review Questions

1. List the related DSS function categories?
2. A script cannot be used as a function in a spreadsheet
 - True
 - False

Answers

1. Categories are:
 - GIS
 - Time series
 - Indicator
 - DSS scripts
2. False (It can be used)

3. References

- Nile Basin Decision Support System help file (DSS Ver. 2.0)
- Nile Basin Decision Support training material (developed in 2013 and 2014)
- DHI training material for the Nile Basin Decision Support (developed in 2012)
- WP2 Report: NB-DSS WP2 Stage 2 'Data Processing, Quality Assurance and Metadata' report (2012)