



# Nile Basin Decision Support System

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## *Indicator Manager Training Module*

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## Revision History

Version	Date	Revision Description
0.1	23/11/2014	Initial draft
0.2	5/12/2014	Final version for approval
0.3	18/12/2014	Second 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 a 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 Indicator 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 Indicator 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

## Indicator Manager

The files needed to run this tutorial are located in the `..\IndicatorsExp\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:

- Indicator Manager:
  - The DSS help file accessible by clicking on the  button

### 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](mailto: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 indicator definition in general and within the DSS, uses of indicators in the DSS. It then describes the connection between indicators and scripts in the DSS and also the linkage between Scenario Manager and Indicator Manager.
- **Indicator Manager basics:** This lesson introduces you to basic tasks such as activating the manager, organizing indicators in groups within the manager.
- **Indicator definitions:** This lesson shows you how you can add a new indicator. This process involves the following steps:
  - Create a script to calculate the indicator (or use an already created script)
  - Defining the details of an indicator
  - Describing indicator parameter types
  - Assigning the parameters
  - Saving an indicator
  - Calculating an indicator
- **Predefined indicators:** This lesson gives an overview of the DSS predefined indicators. It also shows you how you can expand the predefined indicators

After completing the lessons and exercises in this section you will be able to use the Indicator Manager to manage indicators data within the DSS.

## 2.1. General

### Introduction

This lesson describes some definitions and concepts using indicators 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 an indicator? And what are its uses in the DSS?
- The connection between indicators and scripts in the DSS
- The linkage between Scenario Manager and Indicator Manager

Lesson objectives:

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

- Indicators: concepts and uses in the DSS
- Relation between indicators and scripts and between the Scenario and Indicator Managers

### What is an indicator?

Indicators can be defined as qualitative or quantitative parameters used to describe parts of the water resources system under consideration often in ecological, social, or economic terms. In the context of decision making in water resources, indicators are used to assess the performance of the system under current and anticipated future conditions (human-induced and natural).

For example, the annual generated hydropower per catchment, region or country is an indicator that shows how much hydropower is generated on annual basis. This indicator can be used by decision makers to assess the position of a country, for example, against a national or a regional target. Similarly, the number of households with clean water and proper sanitation at the continent level is an indicator that can also be compared against, for example, the Millennium Development Goals (MDGs).

### **What are the uses of indicators in the DSS?**

In general, indicators are used in either describing the state of a system or in monitoring and evaluation. To describe the state of a system, a number of indicators are defined to describe this system. Those indicators are then measured, calculated or estimated at a certain interval to show the state of different system aspects. In this case indicators are called 'State Indicators'. For monitoring and evaluation, the indicators focus more on the performance or impact of a measure/strategy (e.g. a project) rather than the state of a system. The indicator values are collected at certain intervals (usually much shorter than the state indicators) and then evaluated to check the system progress, spot weaknesses and problems and suggest solutions.

In the DSS, the indicators are used to compare the scenario performance either against a base scenario (e.g. present conditions) or against other scenarios to find the optimum solution to a problem or number of problems. They can also be used in Multi Criteria Analysis (MCA) and Cost Benefit Analysis (CBA). In this case, one or more indicators are used to define a criterion that represents a certain aspect of a scenario (e.g. minimum flow to satisfy environmental conditions). Those criteria are then analyzed and compared to find the most favorable scenario. More details on the use of indicators to compare scenarios to undertake MCA and/or CBA are in the Scenario Manager and Analysis Manager training modules respectively.

It should be also noted that indicators can be time series to show, for example, the trend of one aspect of a system but the DSS does not support generating such type of indicators.

### **Connection between indicators and scripts in the DSS**

In the DSS, a script needs to be assigned to an indicator. This script implements the algorithm that is used to calculate the indicator. No matter how simple or complex the indicator is, a script needs to be created within the Script Manager to calculate the value of an indicator. For more information on creating scripts see the Scripts Manager training module.

### Connection between the Scenario and Indicator Managers

In order to calculate the indicator values for a scenario, Indicators need to be first created for this scenario. Following that, this scenario is run creating a simulation where scenario outputs are stored. These outputs are then used to calculate the indicator values as a post-processing step. Those steps (i.e. creation of indicators, running a scenario and calculation of indicator values) are done within the Scenario Manager. If the simulation is run the indicators defined within the scenarios are added in the indicator manager to simply view the list of indicators under each scenario.

Testing whether a scenario indicator can be calculated or not can also be done in the Indicator manager. But, the indicator needs to be created first within the Scenario Manager because the Indicator Manager can only support static inputs for scripts. To provide dynamic inputs, the indicators are to be defined from the scenario manager (For more information on this topic see the Scenario Manager training module).

### Connection between the Analysis and Indicator Managers

In a Multi Criteria Analysis (MCA) that is done in the Analysis Manager, the Indicator Manager can be used to define indicators which are not based on simulation results (i.e. costs). This is done by defining the indicator within the Indicator Manager and then it can be imported into an MCA within the Analysis Manager (For more information on this topic see the Analysis Manager training module).

### Review Questions

1. What is an indicator?
2. What are the uses on indicators in the DSS?
3. Scripts are needed to calculate and indicator
  - True
  - False
4. Scenario Manager calculates the indicator values with no interaction with the Indicator Manager.

## Indicator Manager

- True
- False

## Indicator Manager

### Answers

1. An indicator is measurable variable that helps you understand where you are, which way you are going and how far you are from where you want to be.
2. In the DSS, the indicators are used to compare the scenario performance either against a base scenario (e.g. present conditions) or against other scenarios to find the optimum solution to a problem or number of problems. They can also be used in Multi Criteria Analysis (MCA) and Cost Benefit Analysis (CBA).
3. True
4. True (The scenario manager calculates the indicators and after a simulation is run, they are added to the indicator manager).

## 2.2. Indicator basics

### Introduction

This section introduces you a number of basic tasks that can be undertaken using the Indicator Manager.

Topics covered in this lesson:

- Description of the Indicator Manager components
- Activating the Indicator Manager
- Organizing indicators in groups within the Indicator Manager

Lesson objectives:

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

- Familiar with Indicator Manager components
- Able to activate the Indicator Manager and organize data within the manager

### Lesson pre-requisites

You have to be familiar with the DSS User Interface basics to take this lesson.

### The DSS Indicator Manager components

Figure 1 shows the components of the DSS Indicator Manager, namely:

1. The Indicators Explorer: where indicators are organized in user defined groups and subgroups.
2. The Indicator definitions Window: There are two Indicators definition interfaces in the DSS, one in the indicator manager and another in the scenario manager. In this training module, the indicator definition window that is part of the Indicator manager is going to be presented to show how you can create or edit an indicator definition.
3. Tools Explorer: in this case it is used only to export and import indicator definitions but these tools these are not specific for indicators. They can be used for other DSS objects.
4. The Properties Window: where the selected indicator or tool properties are displayed, property values are set and selected tools are executed.

# Indicator Manager

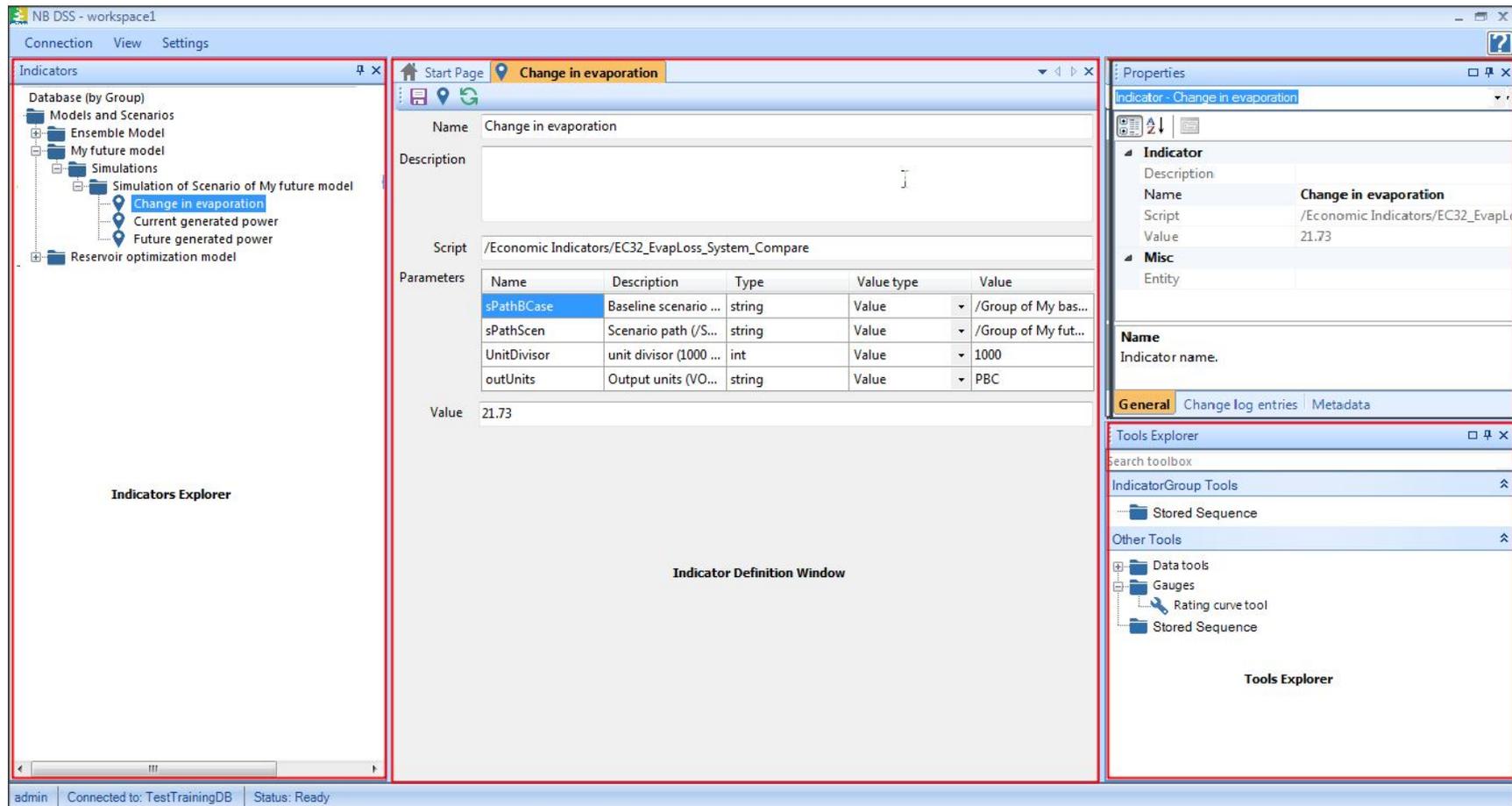
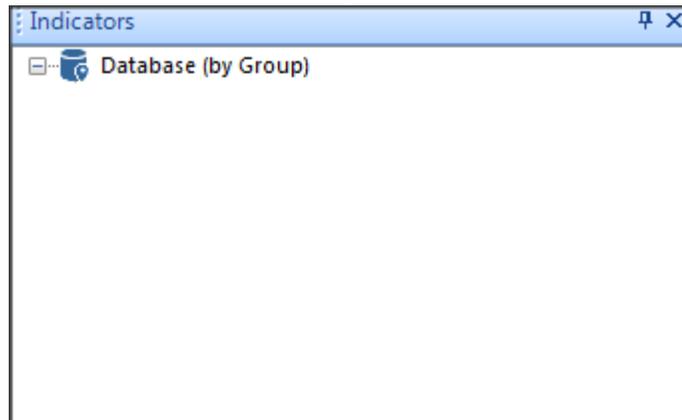


Figure 1: Indicator Manager components

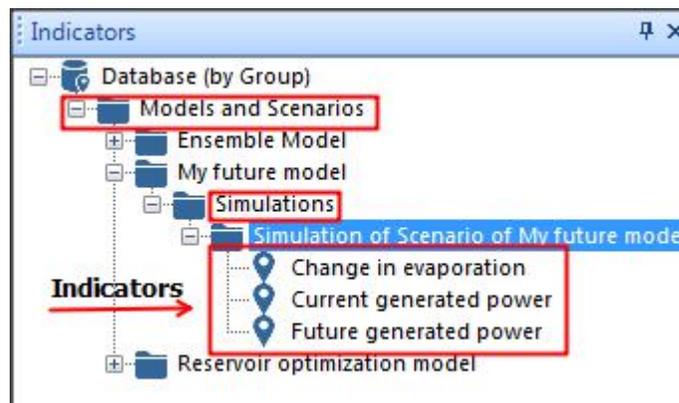
## Indicator Manager

When a new database is created, the Indicators Explorer window has only one main group which is the Database as shown in Figure 2.



**Figure 2: Indicators explorer for newly created databases**

When you first run a simulation for a scenario that has at least one defined indicator under its parent model setup, a group called 'Models and Scenarios' is created within the Indicator Manager. This group contains all simulations that have been undertaken for a scenario with their corresponding indicators as shown in Figure 3.



**Figure 3: Indicators explorer with simulations**

In the 'Indicator definitions' Window, the indicators are defined and can be modified. The definition is saved by clicking the  button in the toolbar. The value of the indicator can also be calculated by clicking the  button in the toolbar or selecting "calculate" from the context menu in the explorer. To synchronize an indicator with a script, click the  button in the toolbar. This synchronization is needed to refresh the script parameters information in the Indicator definition window if you modify script parameters after assigning this script to an indicator to make the definition window 'aware' of this change (i.e. the refresh is not done automatically).

## Indicator Manager

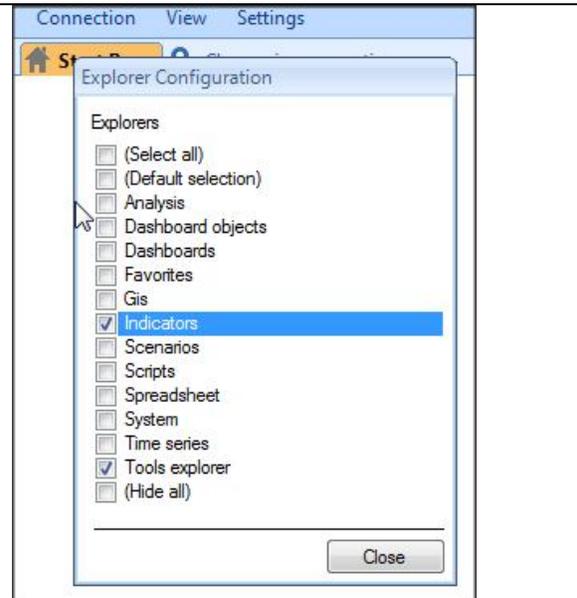
A detailed explanation of using this window is given in the [Indicator definitions](#) section.

The 'Tools Explorer' is used to import and export indicator definitions. The 'Properties' window shows indicator information such as its name, script, and value as shown in Figure 1. But, they are not used much so they are not further described in this module.

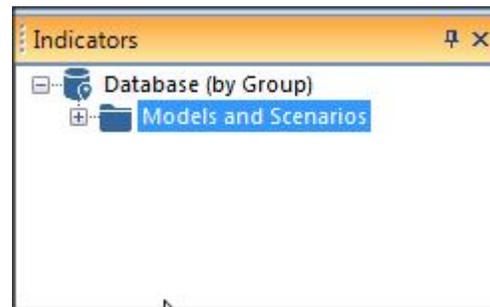
## Exercises

### Activating the Indicator Manager

1- In the DSS, click on **View** Menu, click "Explorers..." and the Explorer Configuration box appears. Tick the box next to 'Indicators' explorer.



'Indicators' explorer should appear within the DSS window. The explorer has a root node 'Database'. This is created by default when a new DSS database is created. Under this main group user can have 'user defined' groups. In addition to the 'Models and Scenarios' group that is created for scenarios with indicators as explained [above](#).

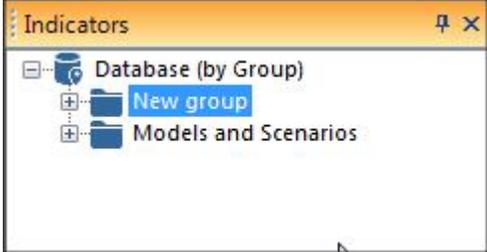
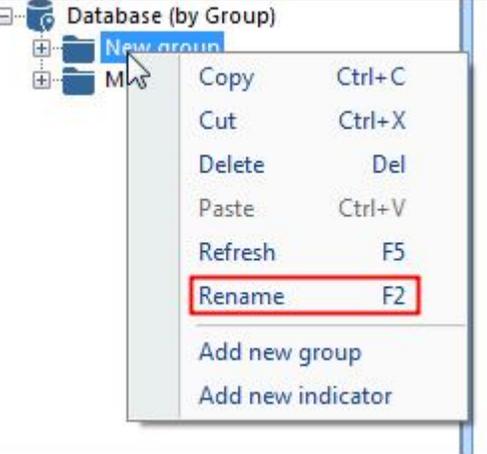
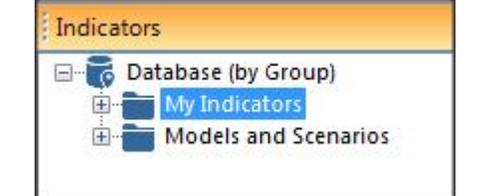


### Adding a new 'user defined' group

1- In the 'Indicators' explorer, right click on the 'Database' group.



## Indicator Manager

<p>2- Click on the <b>Add new group</b> option. A new group is added as shown next.</p>	
<p>3- Select the new group and either right click with the mouse and select <b>Rename</b> or press the keyboard function Key 'F2' to rename it.</p>	
<p>4- Enter a suitable name (e.g. My Indicators).</p>	

### Review Questions

1. List the components of the Indicator Manager.
2. When a new database is created the 'Models and Scenario' group is created by default under the Indicator manager.
  - True
  - False

**Answers**

1. Indicator Manager components are:
  - The Indicators Explorer
  - The 'Indicator definitions' window
  - Tools Explorer window.
  - The Properties window.
2. False (When you first run a simulation for a scenario that has at least one defined indicator)

## 2.3. Indicator definitions

### Introduction

This lesson shows you how you can add a new indicator.

Topics covered in this lesson:

- Create a script to calculate the indicator (or use an already created script)
- Defining the details of an indicator
- Describing indicator parameter types
- Assigning the parameters
- Saving an indicator
- Calculating an indicator

(The above topics cover the definition of an indicator within the Indicator manager. To define an indicator within the Scenario Manager see the Scenario Manager training module)

Lesson objectives:

By the end of this lesson, it is anticipated that you will be familiar with the process of creating indicators in the DSS.

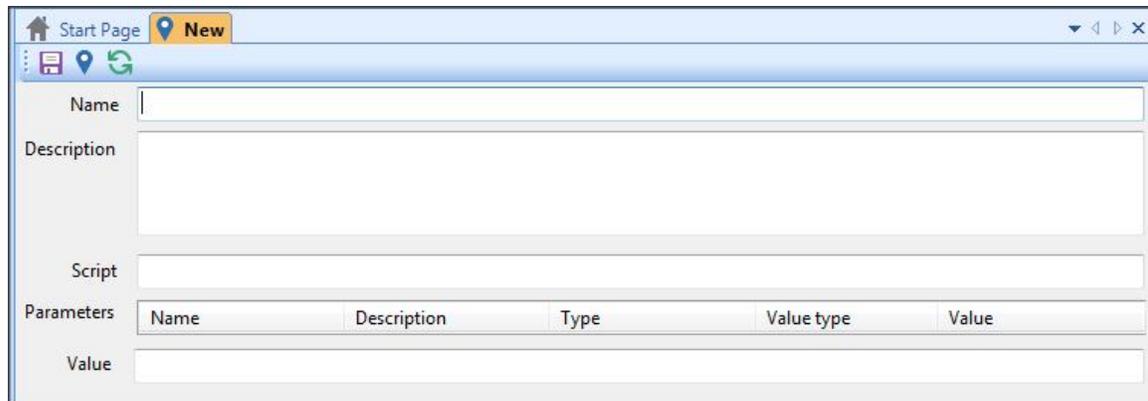
### Lesson pre-requisites

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

### Indicator details

Figure 4 shows the details of an indicator in the DSS.

## Indicator Manager



**Figure 4: Indicator details**

These details are:

- Indicator name: This is a unique name that is given to the indicator in order to use it within the DSS. It is recommended to have short names that are indicative and consistent across scenarios to facilitate comparison and MCA afterwards.
- Indicator description: This is a description of what the indicator does. This is optional and can be left empty. However, it is recommended to be used for documentation of indicators.
- Indicator script: This is the script that is used to calculate the indicator value
- Indicator parameters: These are the parameters that are needed by the script to calculate the indicator. They are described in detail in the following section.
- Indicator value: This is the value of the indicator that is calculated by the script

### Indicator parameters

As explained above, the indicator parameters are one of the indicator details that need to be defined. Those parameters are added to the indicator definition when the script is added. An example is given in Figure 5.

Parameters	Name	Description	Type	Value type
	tsBCase	Baseline timeseries	IDataSeries	Entity id
	tsSC	Scenario timeseries	IDataSeries	Entity descriptor
	factor	Wet season threshold ...	double	Value

**Figure 5: Indicator parameters**

## Indicator Manager

In the above example, the selected indicator requires three parameters and each has a different value type. It is important to understand what each type does to determine which one should be used when creating a new indicator. Those parameters are all defined by the script assigned to calculate the designated indicator.

For time series data, the value type can be either 'Entity id' or 'Entity descriptor'. In both cases the value displayed next to the value type is the path to the time series, but in the database the specification is different.

For 'Entity id' the Indicator holds the ID of the object which is a constant even if the name or path of the time series is changed. This is useful if you are referring to a time series that its path and name can be changed (e.g. a number of future scenarios). When you define an indicator within the Scenario Manager, the value type 'Entity id' is called 'Model reference'. They are used in the same way but have different names.

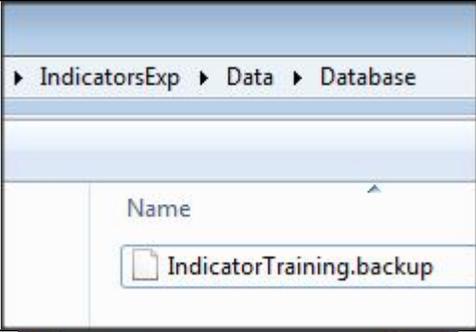
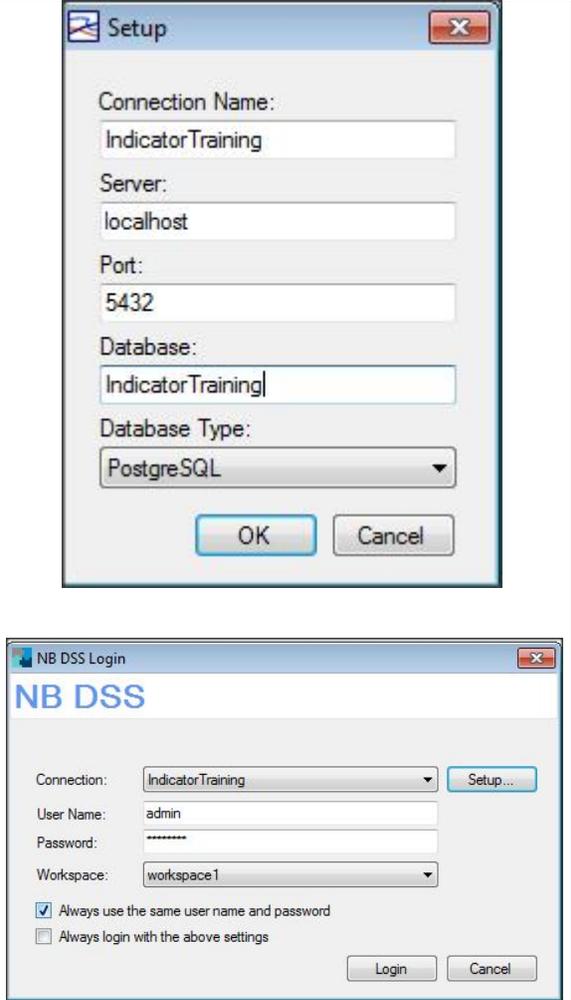
For "Entity descriptor" the database holds the path of the entity (i.e. static value). The path identifies the entity by name and location. This is useful when you are referring to a time series object that has same name and path (e.g. base case scenario).

The last value type is called 'Value' and it can represent number, string or Boolean variables. Numbers can be an integer, a float or a double.

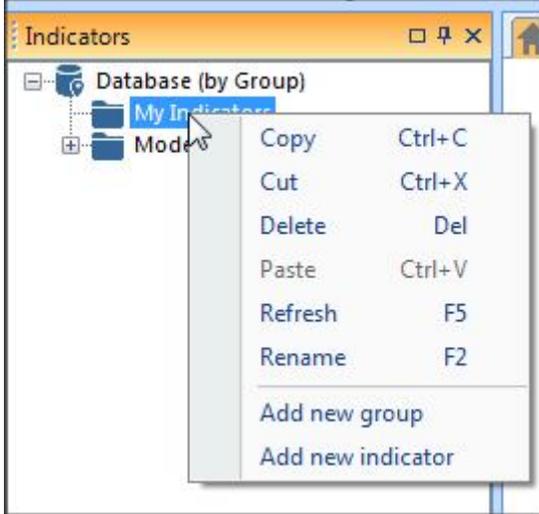
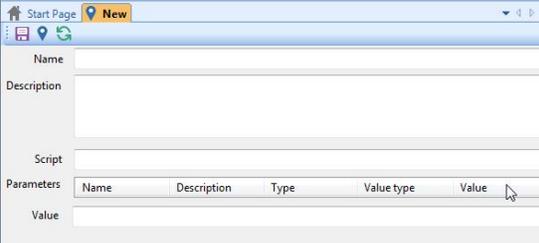
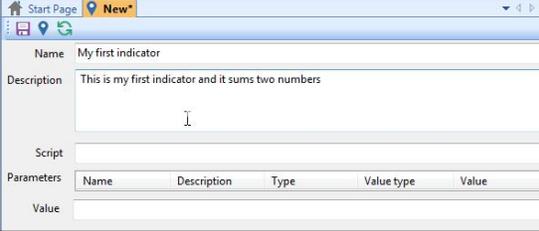
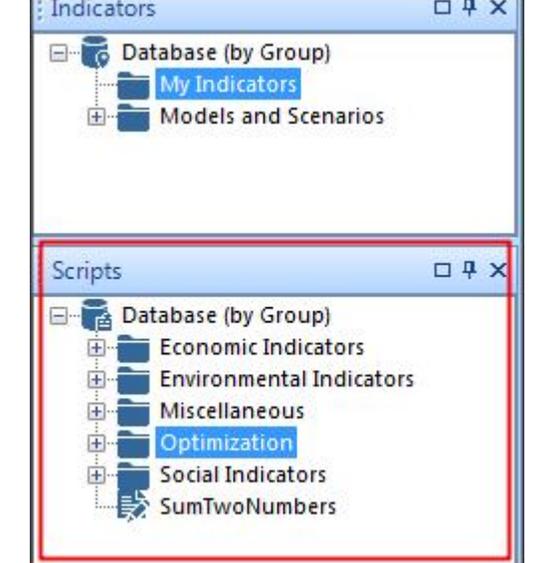
The value type to use will depend upon the nature of the referred entity in order not to break the Indicator definition.

## Exercises

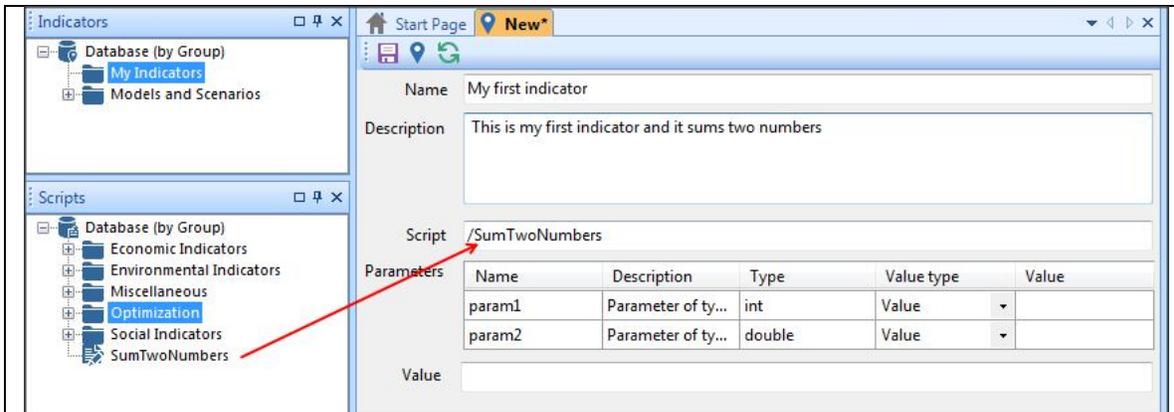
### Adding a new indicator

<p>1- Restore the 'IndicatorTraining' database from <code>..\IndicatorsExp\Data\Database</code> folder (For more information on how to restore a database See the Database Manager Utility and System Manager training module).</p>	
<p>2- Start the DSS and create a setup for the 'IndicatorTraining' database and then use this setup login to the DSS (For more information on how to create a setup and login See the Database Manager Utility and System Manager training module).</p>	

## Indicator Manager

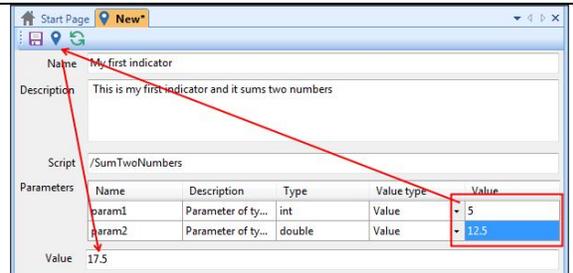
<p>3- In the Indicators explorer, right click on either the 'Database' or a group that is under the 'Database' (e.g. My Indicators).</p>	 A screenshot of the 'Indicators' window. The 'Database (by Group)' tree is visible, with 'My Indicators' selected. A context menu is open, showing options: Copy (Ctrl+C), Cut (Ctrl+X), Delete (Del), Paste (Ctrl+V), Refresh (F5), Rename (F2), Add new group, and Add new indicator.
<p>4- Click on the <b>Add new indicator</b> option. The new indicator window opens as shown next. In this example you will create an indicator that sums two numbers.</p>	 A screenshot of the 'New' indicator window. It has fields for Name, Description, and Script. Below these is a 'Parameters' table with columns: Name, Description, Type, Value type, and Value. The 'Value' column is currently empty.
<p>5- Give the indicator a name (e.g. 'My first indicator') and optionally a description (e.g. 'This is my first indicator and it sums two numbers').</p>	 A screenshot of the 'New' indicator window. The 'Name' field contains 'My first indicator' and the 'Description' field contains 'This is my first indicator and it sums two numbers'. The 'Script' field is empty. The 'Parameters' table is visible below.
<p>6- Activate the Scripts Manager (For details see the Scripts Manager training module).</p> <p>Open and explore the 'SumTwoNumbers' script (See the Script Manager for details). Check how many parameters it has and what it returns (For details see the Scripts Manager training module).</p>	 A screenshot of the 'Scripts' window. It shows a tree view of script categories: Economic Indicators, Environmental Indicators, Miscellaneous, Optimization, Social Indicators, and SumTwoNumbers. The 'SumTwoNumbers' script is highlighted with a red box.
<p>7- Drag the script 'SumTwoNumbers' and drop it into the script box as shown below.</p>	

## Indicator Manager

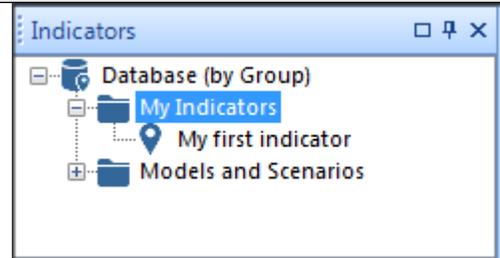


Note that the path script is added and two parameters of value type 'Value' are added to the indicator parameters.

8- Specify the values to use and click the  button to evaluate the script with the parameters. Check whether the calculated value is correct or not.



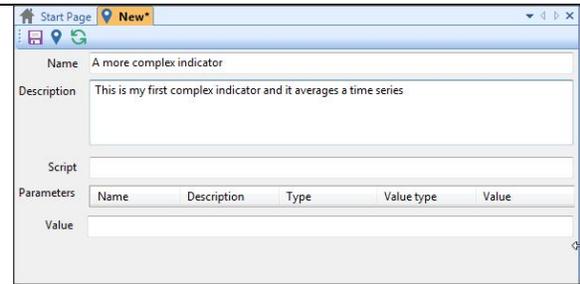
9- To save the indicator, click the  button to store the Indicator definition (script reference, parameter list and calculated value).



The Indicator name now appears in the Indicators Explorer

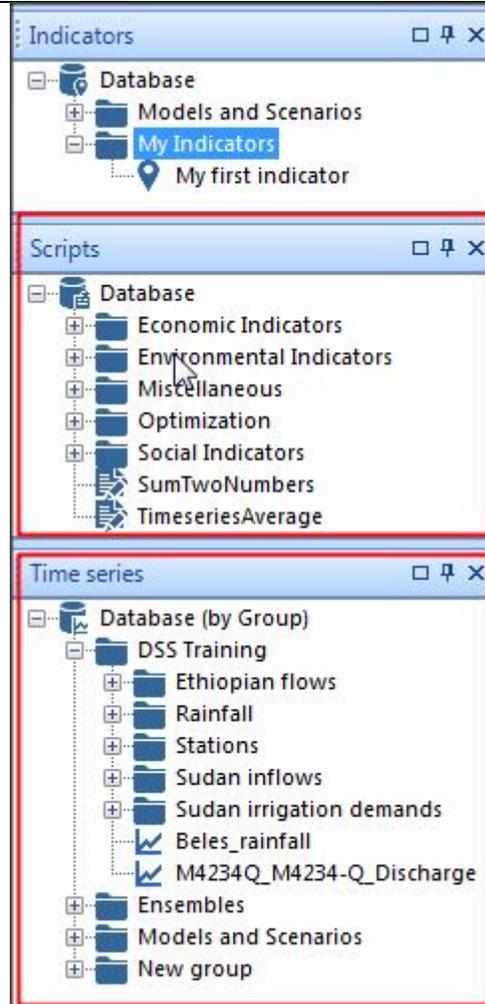
**Defining a more complex indicator**

1- Repeat steps 1-3 from the above exercise but give the indicator a different name (e.g. 'A more complex indicator') and optionally a description (e.g. 'This is my first complex indicator and it averages a time series').



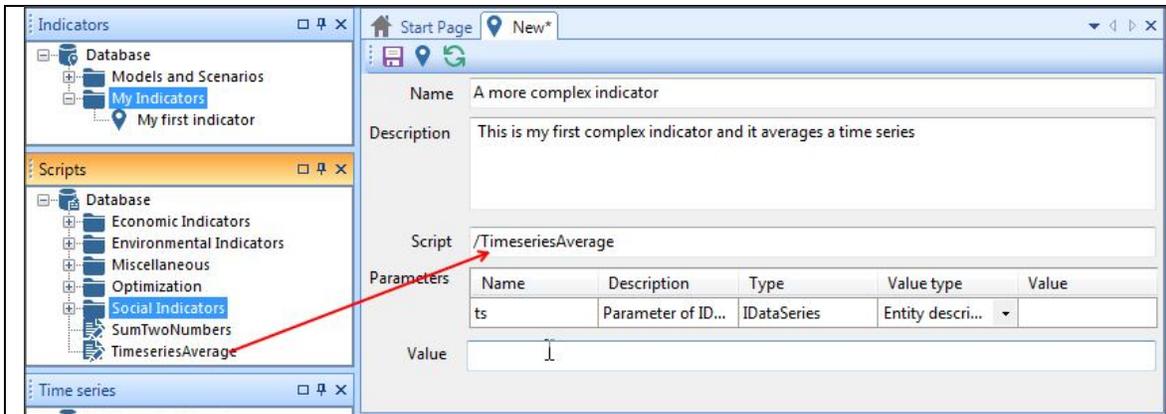
2- Activate both the Scripts and Time Series Managers (For details see the Scripts and Time Series Manager training modules).

Open and explore the 'TimeseriesAverage' script (For details see the Script Manager training module). Check how many parameters it has and what it returns (For details see the Scripts Manager training module).



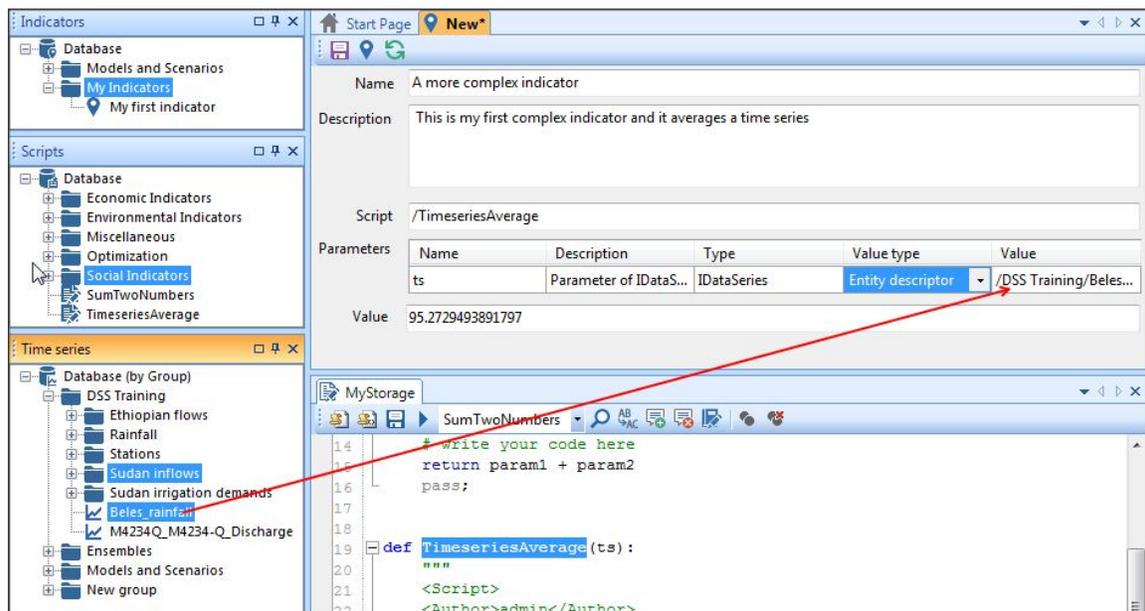
3-Drag the script 'TimeseriesAverage' and drop it into the script box as shown below.

## Indicator Manager



Note that the path of the script is added and one parameter of value type 'Entity description' is added to the indicator parameters. Also note that the parameter type in this case is 'IDataSeries' which means a time series.

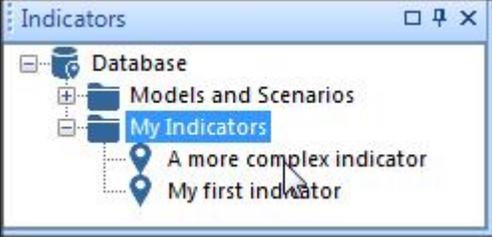
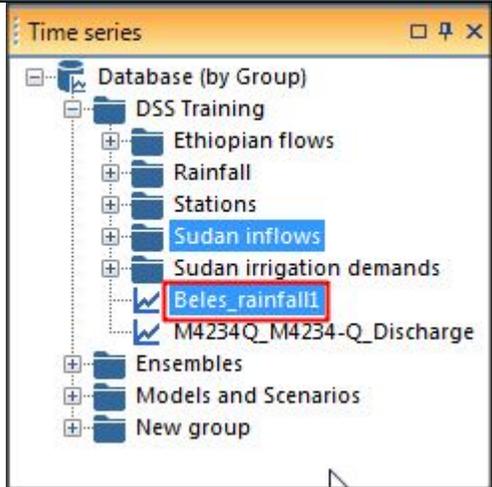
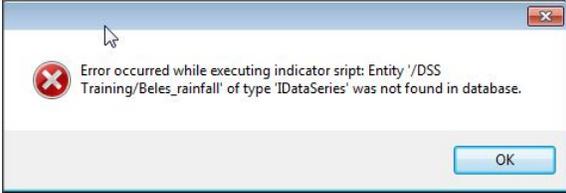
3- Drag a time series (e.g. 'Beles\_rainfall') from the Time Series Manager into the 'Value' box as shown below.



4- Click the  button to evaluate the script with the parameters.

Value 95.2729493891797

## Indicator Manager

<p>5- click the  button to store the Indicator definition (script reference, parameter list and calculated value).</p>	
<p>6- Select the 'Beles_rainfall' in the Time Series Manager. Press 'F2' to and rename it to 'Beles_rainfall1'.</p>	
<p>7- Click the  button to evaluate the script with the parameters. This time, you get an error message that the time series does not exist in the database.</p> <p>Can you explain why this happened?</p> <p>Rename the time series back to 'Beles Rainfall' and repeat the exercise but changing the 'Value type' to 'Entity id'. What do you notice?</p>	

### Review Questions

- 1- What are the details of an indicator in the DSS?
- 2- What are the different 'Value Types' of an indicator?
- 3- An indicator parameter with a value type 'Entity ID' holds the path and location of the entity.
  - True
  - False

### Answers

- 1- Indicator details are:
  - Indicator name: This is a unique name that is given to the indicator in order to use it within the DSS.
  - Indicator description: This is a description of what the indicator does. This is optional and can be left empty.
  - Indicator script: This is the script that is used to calculate the indicator value
  - Indicator parameters: These are the parameters that are needed by the script to calculate the indicator. They are described in detail in the following section.
  - Indicator value: This is the value of the indicator that is calculated by the script.
- 2- The different 'Value Types' of an indicator are
  - 'Entity id'
  - 'Entity descriptor'
  - 'Value'.
- 3- False.

## 2.4. Predefined indicators in the DSS

### Introduction

This lesson gives an overview of the DSS predefined indicators. It also shows you how you can expand the predefined indicators.

Topics covered in this lesson:

- Who developed this set of predefined indicators
- Definition of each indicator showing its function, data types and assigned script.
- Expanding the predefined indicators in the DSS.

Lesson objective:

After completing this lesson, you will be familiar with the predefined indicators in the DSS and you will know how to expand this set of indicators

### Lesson pre-requisites

You have to be familiar with Indicators' basics and definitions (See the [indicators' basics](#) and [definitions](#) sections for details) to take this lesson.

### Who developed this set of predefined indicators

During the development of the Nile basin DSS, a number of consultation meetings and workshops were held to identify the key indicators that stakeholders in the Nile Basin are most interested in. This was part of a consultancy called 'Data Compilation and Pilot Application of the Nile Basin Decision Support System'. Based upon the discussions between the stakeholders, the consultant identified a number of key indicators that can be used in the DSS to evaluate scenarios and undertake MCA and CBA. These indicators were divided into the following three categories:

- Social indicators
- Environmental indicators
- Economic indicators

The definition of each indicator is given in the following section. More details on this can be found in the 'Predefined scripts in the DSS' section of the Script

## Indicator Manager

Manager training module and 'Section 3' of the NB-DSS WP2 Stage 2 report 'Guideline for the Evaluation of Water Management Interventions' (A full copy of the report can be found in the **..\IndicatorsExpData** folder).

**Definition of each indicator**

In this section, for each predefined indicator, the following is presented:

1. Indicator sub-category
2. Indicator script name
3. Indicator description

**Social Indicators**

Sub-category	NB-DSS Script name	Description
Water Availability	SO1_WaterAvailability	Calculates the change in availability of water for riparian users: domestic consumption, subsistence agriculture and livestock
Community Health and Safety	SO2_MalariaEndemicity	Calculates the susceptibility of irrigation scheme areas to malaria based on WHO malaria incidence map for Africa
	SO3_PestDiseasePrevalence	Calculates the prevalence of diseases resulting from pest species
	SO4_UrbanPollution	Calculates the water pollution downstream major urban areas
	SO5_HouseholdsFlooded	Calculates the No households within the 100 year flood line
	SO6_DrowningRisk	Calculates the drowning risk due to conveyance of water in an open canal
Food security and Livelihoods	SO7_Formallrrigation	Calculates the footprint area due to establishment of new irrigation schemes
	SO81_RecessionAgricFloodPlain	Calculates the impact on Recession agriculture due to floodplain inundation
	SO82_RecessionAgricBank	Calculates the impact on Recession agriculture due bank instability
	SO91_FishProductionDam	Calculates the change in fish productivity in a dam, lake, or wetland

## Indicator Manager

Sub-category	NB-DSS Script name	Description
	SO92_FishProductionRiver	Calculates the change in fish productivity along a river reach
	SO10_ProductiveLandUse	Calculates the productive land use for crops, grazing inundated by dam or lost due to establishment of an irrigation scheme or a canal
	SO11_LossNaturalResources	Calculates the change loss of access to natural resources due to inundation by dam or establishment of an irrigation scheme or a canal
Displacement	SO12_PhysicalDisplacement	Calculates the physical displacement of population due to inundation by a dam, establishment of an irrigation scheme or construction of a canal
	SO13_EconomicDisplacement	Calculates the economic displacement due to disruption of access to natural resources (cattle, people, wildlife) as a result of a canal and/or a dam construction

**Environmental Indicators**

Sub-Category	NB-DSS Script Name	Description
Footprint Areas	EN1_EnvSensitiveAreas	Calculates the extent of Environmentally Sensitive Area within a dam, irrigation scheme or canal footprint
	EN11_EnvSensitiveRating	Calculates the impact rating on environmentally sensitive area within a dam, irrigation scheme or canal footprint
	EN12_HotspotRating	Determines the wetlands of international importance (Ramsar Sites) and Important Bird Areas (IBAs) that fall outside of protected areas, but within primary impact zones.
	EN2_Carbon	Calculates the area of woody biomass and biomass carbon within dam footprint
	EN3_FishProduction	Estimates fish production from a dam, lake or a wetland
Downstream Areas	EN4_FloodPlainInundation	Calculates the floodplain area inundated compared to a baseline
	EN42_WetlandArea	Calculates the wetland area inundated compared to a baseline
	EN5_EcoStressRating	Determines ecological stress rating from changes in key flow components and flow variability compared to baseline.
	EN6_WetDuration	Calculates the wet season duration based on median monthly flows
	EN7_BlackFlyRating	Determines black fly rating from HP operation, changes in low flows and variability compared to baseline.
	EN8_BankStability	Calculates bank stability rating downstream of impoundment based on standard deviation of flows and predefined sinuosity
	EN9_RecoveryDistance	Estimates recovery distance based on median discharge from impoundment and distance to downstream tributary
EN10_WetSeasonShift	Calculates number of weeks delay in the onset of wet season compared to a baseline	

Indicator Manager

Water Quality	EN11_PhytoPlankton	Estimated the phytoplankton growth potential based on empirical relationship with retention time
	EN12_AquaticMacrophyte	Estimates aquatic macrophyte growth potential based on empirical relationship with nitrate concentration in irrigation scheme return flow

**Economic Indicators**

Category	NB-DSS Script Name	Description
Navigation	EC1_Navigation	Calculates number of days above baseline flow threshold or change relative to baseline
Energy	EC21_AverageEnergy	Calculates average energy generated at specific hydropower node over a specified period
	EC22_AverageEnergy_System	Calculates system wide average annual energy
Water conservation	EC31_EvapLoss	Calculates average annual evaporation from a dam, a wetland or a lake
	EC32_EvapLoss_System	Calculates system wide average annual evaporation
Floods	Flood Damage	Calculates flood damage based on damage-depth relationships for different land use types
Food production	EC51_FoodProductionSingle	Calculates food production of new irrigation schemes
	EC51_FoodProduction	Calculates the potential reduction in crop yield of existing irrigation schemes due to upstream developments
	EC51_ProductionIncomeSingle	Calculates actual crop income of new irrigation schemes
	EC51_ProductionIncome	Calculates change in crop income of existing irrigation schemes due to upstream developments

## Expanding the DSS predefined indicators

To expand the DSS predefined set of indicators, you have the following two options:

- Add a new indicator: In this case you need to do the following:
  - Define the indicator you need to calculate
  - Identify the algorithm that can be used to calculate the indicator
  - Identify the data that is needed to calculate the indicator. This can be external (i.e. data does not exist in the DSS but can be organized in spreadsheets and imported into the DSS) or internal (e.g. generated by DSS Modeling tools).
  - Write a script to calculate the indicator value
  - Add the script to the Scripts Manager
- Modify an existing indicator: This option might be needed if you think that the existing method of calculating an indicator needs to be improved. In this case you need to do the following:
  - Identify the new formula that can be used to calculate the indicator
  - Identify the data that is needed to calculate the indicator. This can be external (i.e. data does not exist in the DSS) or internal.
  - modify the existing script<sup>1</sup> to calculate the indicator value

Developing new indicators and modifying existing ones entails consultation with stakeholders on the meaning and methodology of the indicators in addition to scripting knowledge (refer to the Script Manager Training Module) to program it.

## Review Questions

1. What are the main predefined indicator categories in the DSS?
2. The DSS predefined set of indicators cannot be expanded.
  - True
  - False

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<sup>1</sup> It is always advisable to keep a copy of an existing script before modifying.

**Answers**

1. The predefined indicators are divided into the following three main categories:
  - Social indicators
  - Environmental indicators
  - Economic indicators.
2. False (it can be expanded).

### **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 Guideline for the Evaluation of Water Management Interventions (2012)