Deltares

Tutorial Habitat 3.0

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Deltares

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Abstract
This tutorial contains three exercises to get acquainted to the HABITAT software.

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1 Introduction

1.1.1.1 HABITAT spatial analysis tool

HABITAT is a spatial analysis tool to support the development of river basin management plans. It is especially designed for ecological assessments to analyse the availability and quality of habitats for individual or groups of species. Its applicability is not restricted to ecological purposes, it can be used for any spatial analyses where grid operations are needed such as flood risk maps or damages to agriculture or urban areas in case of floods and droughts. The tool has been built around PCRaster[1], a software package for map-calculations, and is developed by Deltares. The main characteristic of HABITAT is that it provides a platform for grid operations without highly advanced programming skills from the user via the user interface. This makes it usable for a broad audience.

The spatial representation allows for a quick recognition of suitable areas. HABITAT helps the user to systematically follow cause-effect chains and simulate each step in knowledge rules, which may be based on monitoring results and/or expert knowledge. By making the knowledge explicit the impact assessment method becomes transparent and re-usable. Combined relations and effects can be analysed by using knowledge rules for different environmental factors and measures. Basic statistical functions can be used to summarise the results. The systematic approach allows for an easy comparison of different strategies and a better understanding of the ecosystem and its relevant steering variables. The tool applies knowledge rules to maps (grid cells) (Figure 1.1), using data in different data layers and/or a number of adjoining cells. As the analysis is performed on maps, the heterogeneity of areas and consequently the diversity of the environment can be taken into account.

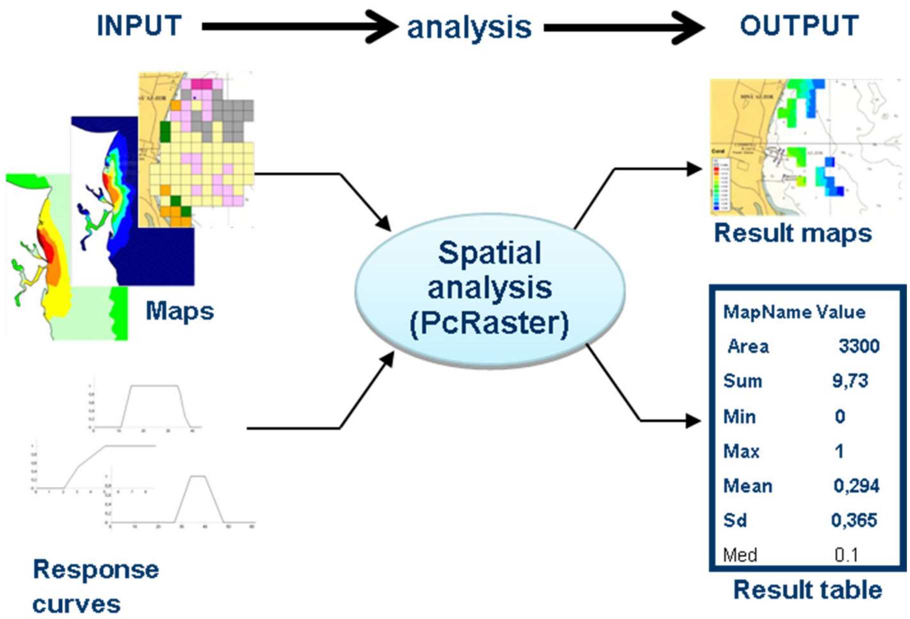


Figure 1.1 Working of HABITAT tool.

Within HABITAT, knowledge rules developed for specific studies can be stored in a knowledge database (habitat.deltares.nl) and therefore re-used and adapted for other studies.

1. http://www.pcraster.nl

For the HABITAT tool, Deltares has adopted the principle ‘Dare to Share’[2] in order to enhance knowledge exchange through the HABITAT website and thereby improve the quality of studies done with HABITAT. Furthermore, HABITAT is freely available for users which are willing to share their developed knowledge rules as part of the ‘Dare to Share’ principle. The use of a common framework, knowledge base and tool can promote the sharing of knowledge and experiences on a level that transcends country boundaries and disciplines.

1.1.1.2 Outline of the tutorial

This tutorial contains 3 exercises to get acquainted with the HABITAT tool. In the first exercise you will implement two habitat suitability models and export them. In the second exercise these models are reused (import) to run scenarios. The results are analysed by looking at the result maps and calculated statistics. The third exercise shows how to develop an ecotope classification, analyse the results and calculate the statistics of a map.

2. *Soekijad, M. (2005). “Dare to share - Knowledge sharing professionals in co-operative networks”. PhD thesis. Technical University Delft. ISBN:90-9019565-3*

2 Exercise 1: Habitat Suitability Index model

A habitat is an area in which a specific species lives. The suitability of a habitat is determined by the biotic and abiotic environmental conditions and land use. In this exercise we will make a habitat suitability index model (HSI) for the habitat type 3140 'Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp*.' of the Habitat Directive and for herbivorous water birds.

(www.dcnr.state.al.us) (www.fotonatura.com)

Figure 2.1 Examples of Chara spp (left pane) and of Cygnus bewickii, a herbivorous waterbird (right pane)

These HSI models describe the suitability based on environmental conditions (abiotic, biotic and management). Models can have different formats. Most of them exist of response curves between the environmental condition and the suitability for the (group of) species, indicated with a value between 0 (not suitable) and 1 (high suitable area). The final suitability is the minimum of the results of the relations of the used environmental conditions, which means that the most limiting factor is determining the final suitability. Another frequently used format is a statistic relation of environmental conditions and the occurrence of a (group of) species. A description of the models used in this exercise can be found on habitat.deltares.nl.

2.1 Implement habitat suitability model for Habitat type Chara spp.

In this exercise a HABITAT model will be made for Lake Markermeer in the Netherlands, for the current situation and for a future situation. The purpose of this exercise is to learn how to set up a suitability model, run different scenarios and to export and import the models.

2.1.1 Preparation

1. **Start HABITAT**
   – Go to the windows start menu: "Program" > "Deltares" > "Habitat 3.0" and select the HABITAT tool.
2. **Save the project**.
   – HABITAT starts with an empty project. You can save it by selecting "File"> "Save Project as…". Use a convenient name, like 'Tutorial Habitat' and make sure you save the project somewhere on your computer where you can find it later on.

– The project is saved as “Tutorial Habitat.dsproj”. The dsproj extension can be compared to a word-document from the Word program or the mxd file from ArcGIS.

The hierarchy within a Project is: Folders, Scenarios, Models (Figure 2.2). Within a project you can have different folders, scenarios and models. Folders can be used to structure your scenarios and scenarios can be used to structure your models. Models are the actual grid processing tools where the dose-effect curves are defined.

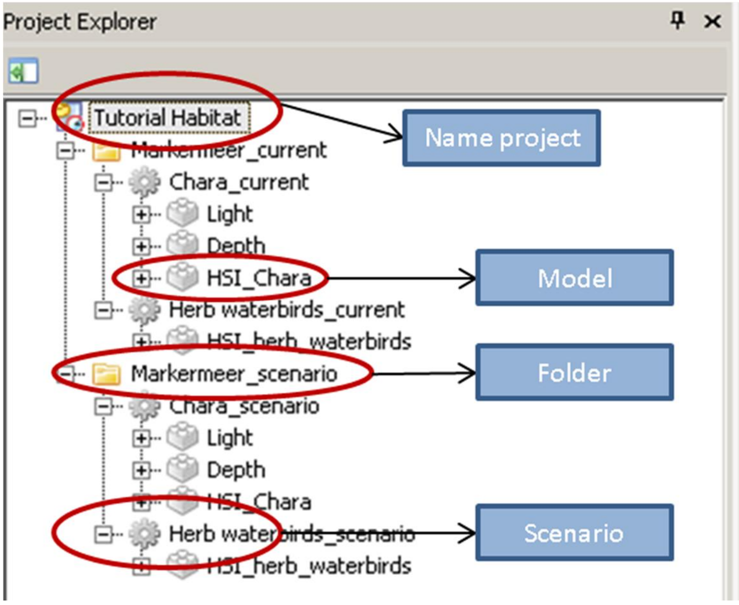


Figure 2.2 Project name and the hierarchy of folders, scenarios and models in HABITAT

For constructing the HSI-model for *Chara spp.* two response curves are needed: one for the water transparancy in terms of the percentage of light reaching the soil and one for the water depth. Next, the total suitability of an area suitable for *Chara spp.* is determined by taking the minimum of the suitability index for both environmental factors. Thus in total, three models are needed to calculate the habitat suitability of *Chara spp.*:

1. Dose-effect relation of the % of light at soil,
2. Dose-effect relation for water depth,
3. Calculation of the minimum of the suitability for the % of light at the soil and water depth.

3. **Make a new folder**.
   – Select from the menu “Poject” > “Add New Folder” or right click on the project name in the “Project Explorer” and choose “Add”> “New Folder”.
4. **Rename the folder**
   – Type directly in the box of the folder’s name by clicking it twice (slowly) or use the properties window at the right side of the screen (it slides into the main window when you put your cursor on the “properties’-tab). Use the name “Lake Markermeer Current”.
5. **Add a scenario**
   – Right click on the folder and select “Add” > “New Model” > “Composite Model”. This scenario is the structure where you will put the actual building blocks (i.e. the models) to calculate the habitat suitability of *Chara spp*. Change the name of the scenario into “Chara_current”, again by clicking it twice.

6. **Add a model**
   – Right-click on the scenario and select "Add" > "New Model" > "Broken Linear Reclassification". This type of model is needed for both the dose-effect relations for %light at soil *and* water depth. The model appears directly in the "Working Area".

7. **Rename the model**
   – Use 'Light' as name for the model.

8. **Define input of the model**
   – Make sure you have the right model active in the "Working Area" (that is the pane where all the newly added models open) by looking at which tab is highlighted. Add an input map by clicking on the box with the dots (Figure 2.3) and choose "Browse", followed by "Raster from file" > "Raster File".

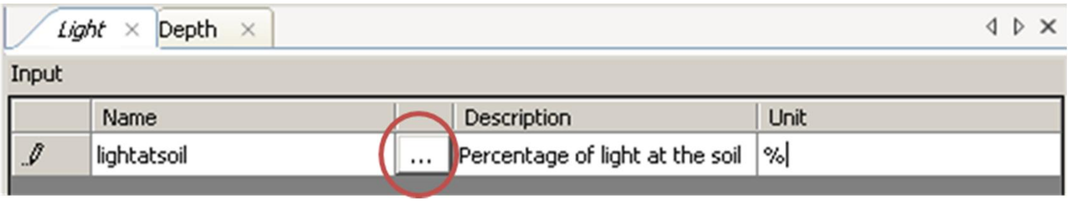


Figure 2.3 Part of the input area of a Broken Linear Reclassification model (in this case the light model). The red circle shows the button that is used to browse for input files.

   – Next, browse to the location of the input maps (they are in the folder Data_Exercise_1) and select the "LightAtSoil.bil" file. Click "Open" or double click on the file. Then click 'Ok". The name of the map is put into the "Name" part of the input table. If you wish, you can change this name in, for example, "Light". Insert a description of the map in the "Description" part (like percentage of light at the soil) and add the unit of the map in the "Unit" part, in this case "%". This kind of documentation helps you to keep track on what maps represents and in what units.

When you put your cursor on the name of the input map, a tooltip appears that shows the location of your map.

9. **Take a look at your input map**
   – Open the "Light" model by clicking on the + in front of it in the "Project Explorer" and do the same for the "Input grids". Double click on the "Light" box. The map opens: this is the map on which you are going to do your first calculation. Close the map by clicking on the - of the Light-tab.

10. **Enter dose-effect relation**
   — add the x and y values in the "Light" model, according to the values below:

X (%)	Y (HSI)
0	0
1	0.2
2	0.5
3	1
100	1

By right clicking at a row (gray part), you can delete a row. Hold “control” to select and delete multiple rows.

11. **Define output**
   – Enter a variable name like “HSI_Light” in the output part of the model. Add once again a description (“habitat suitability for Chara spp. regarding light at soil”) and a unit (ratio).

12. **Add another response curve for water depth**
   – This is also a broken linear model. Add the input map for water depth (“WaterDepth.bil”) and enter a description and unit of the input and output map. Rename the model to ‘Depth’. Enter the dose-effect relation according to the table below (*notice that the water depth map is in cm and the maximum depth 25 m)*.

The result map gets only values for the range of the broken linear function. For example if the function stops at 40% then grid cells with a value higher than 40 will get ‘no data’ as a result.

X (m)	Y (HSI)
0	0
0.3	1
3.0	1
3.5	0
>3.5	0

The Broken Linear model does not work with < and > signs.

13. **Add a formula based model**
   – Right click on the scenario and “Add New Model” > “Formula-based calculation”. Rename the model to “HSI_Total_Chara”. This model calculates the final habitat suitability for *Chara spp.* regarding light at the soil and water depth.

14. **Define input by linking maps**
   – Click on the white line (so the second input line) below the browse button and choose cancel at the pop up screen: now you have made two input lines. This is convenient as you can now link the output maps of the “Light” and “Depth” models to this model just by dragging: click on the + in front of the “Light” and “Depth” models and click also on the + in front of the “Output grids”. If the input grids of the formula based model is not visible yet, use the + in front of the model in the “Project Explorer” and make the input grids visible.
   – Select the HSI_Light map in the Project Explorer and drag it to the standard input variable of the Chara model. You can see from the arrow that you can drop the map. Do the same for the HSI_Depth map. An arrow at the input maps in the “Project Explorer” show that it is linked.

15. **Enter formula**
   - After the input variables are defined, it is possible to enter a formula to calculate the total habitat suitability. Define the name of the variable that is calculated, for instance “HSI_Chara_Current”, in the first column of the equation part (this is also your output name). As you need the minimum value of both input maps, type in the second column of the equation part: min(HSI_Light, HSI_Depth) (use space after the comma). You can use the dropdown menu (Figure 2.4) to avoid typo’s or just for convenience. This formula calculates for each grid cell the minimum value and writes it to the output file.

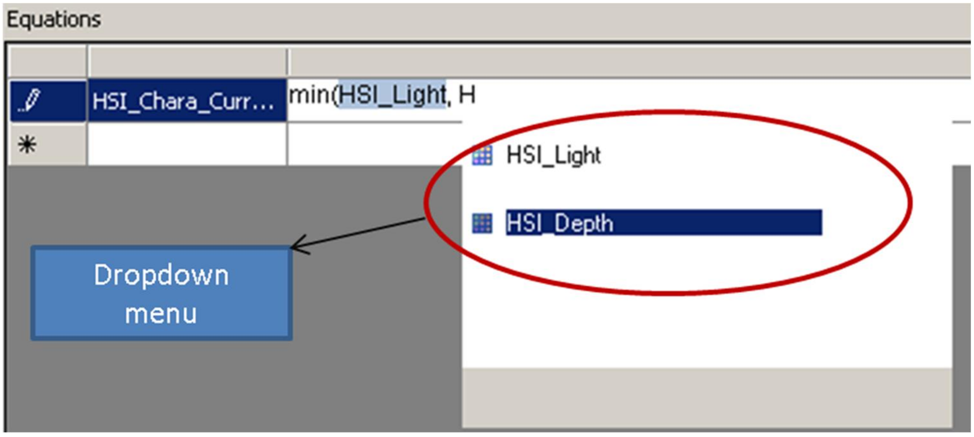


Figure 2.4 Illustration of dropdown menu in formula-based model.

Pressing F1 in the equation part of the formula-based models show all possible input maps and all formula’s that can be used.

The calculation order of the models is the same as the order of the models in the Project Explorer tree.

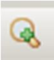
Linked maps cannot be renamed.

To learn more about the formulas visit the PCRaster website on formula’s. In the table below some frequently used formula’s are explained.

Symbol/statement	Description
*	Multiplies the values of two maps
**	Calculates a power of a map
-	Subtracts the values the second map from the first map
+	Adds the values of maps
/	Divides the first map by the second map
exp()	Calculates the exponent of values on a map
max()	Determines for each cell the maximum value of the multiple expression
min()	Determines for each cell the minimum value of the multiple expression

If then If(map1==map2,1,2) (if cell of map2 is equal to the same cell of map1, then assign a 1 to the output map, otherwise a 2)	If then (or if then else) statement. Instead of equal sign (==), you can also use < (smaller then), > (greater then) or a combination => to include certain values.

16. **Define the output**
   – The output name is already filled out, but fill out also the description and unit part of the output.
17. **Run the scenario**
   – Right click at the scenario “Chara_current” and select “Run Model”.

18. **Analyse results**
   – Open the output map HSI_Chara_current and have a closer look at the results by zooming in **->** . Zoom back to full extent with this button: 
19. **Import legend**
   – Replace the current legend by another one by importing a legend. Go the “Map Contents” window and right click on the “output” map. Choose “Import Legend”, browse to the legend folder and select “HSI_Markermeer.dsleg” and press “Open”.

You can also make your own legend by clicking on “Properties” instead of “Import Legend”. In the pop-up window you can choose your type op legend, pick your own class limits and define your own colours. If you want to reuse your self-made legend in other projects select, when right clicking on the output map in the “Map Contents” window, for “Export Legend

20. **Look at map values**
   – Next to look at the colours of the map to get a clue of habitat suitability, you can also look at the actual map values: click on the info icon:  and move your mouse over the map: a tooltip appears and shows the values of the map.

It is possible to have several maps open at the same time in the “Working Area”: drag the tab of a map into the “Working Area” and you can choose in what part of the window you want to have the map (Figure 2.5).

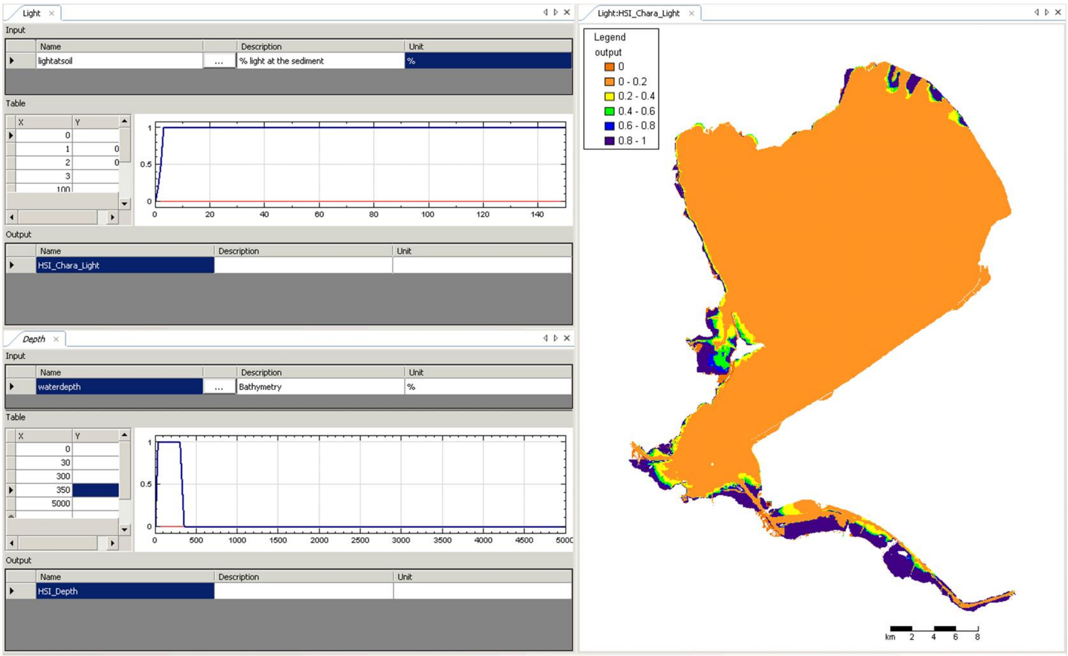


Figure 2.5 multiple windows in the “Working Area” window.

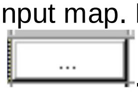
You can see the coordinates of your map at the lower left corner of the HABITAT window when moving the mouse over the map.

2.1.2 Implement habitat suitability model for herbivorous water birds

In principle, this exercise is the same as the one with *Chara spp.*, but now is one of the input maps for the herbivorous water birds the total HSI map of *Chara spp.* and do we use a multiple reclassification table.

21. **Add a scenario**
    – Add a scenario to the folder of Lake Markermeer Current’. Change the name of this scenario into ‘water birds’.

22. **Add a model**
    – Add a multiple reclassification model and rename it to “herbivorous water birds”.

23. **Define input**
    – The aim of the model is the get insight in the food availability for herbivorous water birds. Therefore we need information on the available food resources (i.e. *Chara spp.*) and we need to know whether the food is available for the birds regarding for instance diving depths. Thus, link the output map of the model for the habitat type *Chara spp.* as one of the input map. Next, add as a second map the water depth. Use for this the browse button .

24. **Enter the response curve**
    – As this is a multiple reclassification table, all the combinations between both input maps should be defined and related to different habitats for different birds. Use the values of the table below as input.

Classification table

HSI_chara_total	waterdepth	Output...	Description
<,>	<,0>	0	Land
[0.5,1]	[0,20>	10	Geese, swimmimg ducks
[0.5,1]	[20,50>	20	Swimming ducks, geese, swans
[0.5,1]	[50,100>	30	Swans
[0.5,1]	[100,200>	40	Diving ducks
[0.5,1]	[200,>	50	Not available for birds
[0,0.5>	[0,>	60	No macrophytes

Pay attention to the notation format given below:

"[" means the value belongs to the range, ">" means it does not. For example:

<1, 3]	All grid cells with a value from 1 to 3 (without 1 and including 3)
[5,>	All grid cells with a value equal or larger than 5
4	All grid cells with exact the value 4
<,>	All values

25. **Define the output**
    – Name the output map as "HSI_Water_Birds_Current'

26. **Run the model**
    – Right click at the model 'herbivorous water birds' in the Project Explorer and select "Run Model"

27. **Open output map**

28. **Import legend**
    – Right click on output map in the "Map Contents" window, select "Import Legend" and browse to "HSI_Herb_Water_Birds.dsleg" and click "Open".

29. **Analyse results**
    – Open the map "HSI_Water_Birds_Current". What do you see? Are there places on the map where the birds cluster? How come?

To give an impression of the blue and green colours on the map, see the table below

Output value	waterdepth	herbivorous waterbirds in this habitat
10	<20 cm	
20	20-50 cm	
30	50 -100 cm	
40	100 – 200 cm	

2.2 Export and import function

In Habitat you can export folders, scenarios or individual models by right clicking on the specific level and choose export.

30. **Export the folder**
    - If you are satisfied about the results, you can export the folder “Markermeer_current”, together with the input files. This makes it possible to exchange models with other HABITAT users. Right click on the folder and select “Export …”. As a result the export/import wizard pops up. Choose “Next”, “Keep references to external files” and browse to the location you want to export to. Type the name you want to give your export and click “Ok”> “Next”>”Finish”.

31. **Save the project**

32. **Close HABITAT**

3 Exercise 2: Calculating scenarios, compare results.

In this exercise the HSI models of exercise 1 are used to calculate a scenarios and compare it to the current situation. In the scenario an island is constructed in the north-west part of the Lake. In addition, embankments are created to reduce the influence of the wind. Furthermore, the water level is changed from a mean summer water level of -20 cm NAP to -33 cm NAP, which is the lowest possible water level considering the boundary conditions given by shipping and water supply for this lake.

1 **Open HABITAT**

2. **Open your project**
   – "File">"Recent">"HABITAT_tutorial.dsproj"

3. **Import the exported folder**
   – Right click on the project's name and select "Import…". Choose "Project" and the export/import wizard pops up. Browse to your exported file and import it. Rename the imported folder to "Lake Markermeer land use".

4. **Rename output variables**
   – Rename the output variables of the total habitat suitability of the "Lake Markermeer land use" to "HSI_chara_total_scen" and "HSI_Waterbirds_scen".

It is also possible to copy a folder. Select the folder in the Project Explorer, press 'ctrl' and drag the folder to the preferred location. The allowed locations are indicated with the appearance of a plus sign under the pointer of the mouse while dragging.

To calculate a scenario you now only have to change the input files for the models in the folder 'Lake Markermeer land use'. Use the scenario maps of water depth and percentage of light at the soil in the folder: **Data_Exercise1\Scenario.**

5. **Change input file for the scenario**
   – Double click at the folder of 'Lake Markermeer Water and Land use' in the Project Explorer. This gives an overview of the input and output maps within the scenario. Change for *Chara spp* the input maps of the percentage light at the bottom and the water depth and for the herbivorous birds the input map of the water depth by adapting the location reference of the maps.

6. **Open input maps**
   – Double click at each of the input maps and explore the difference between the new input maps and those of the current situation regarding the percentage of light at the soil and the water depth. If needed change or import legends.

7. **Run the scenario models**

8. **Analyse the results**
   – Open the output maps. Check for unexpected white spots and if they are present, adapt your models in such a way that the white spots are filled up. Next, arrange the windows of the output maps in such a way that they are easily compared.

9. **Add a folder and scenarios**.

- Rename the folder to “statistics” and add a scenario to this folder, renaming it to “Difference”. This scenario will be used to calculate the differences between the two calculations.

10. **Add a formula based model to the “Difference” scenario**

11. **Link output maps**
    – Link the total HSI output maps of *Chara spp* and the herbivorous waterbirds of both folders (so the current situation and the scenario) to the model.

12. **Insert formulas**
    – Add two equations to calculate the difference between both suitability maps for the scenarios.
    Chara spp:

Dif_Chara = HSI_Chara_total_scen – HSI_Chara_total

As the values in the water birds maps are codes for habitats, they cannot be substracted. To get an indication of the differences, enter the following formula:

Dif_wbirds = if(HSI_WBirds_Cur != HSI_WBirds_Scen, 1,0).

This will result in a map which has a value of 1 in areas where two maps differ and a value of 0 where the maps are the same.

13. **Add a spatial statistics model**
    – Change the name of the model in the properties window to ‘Stat Chara Current’ and add meta-data.

The spatial statistics model calculates the minimum, maximum, average, median, standard deviation of the whole map or for a part of the map. Furthermore, the model can calculate those values for different classes of values, e.g. the habitat suitability between 0 - 0.7 and 0.7 and 1.

14. **Prepare the statistics model**
    – Link the HSI_Chara_total to the input of the statistics model and add classes for the habitat suitability like in the picture below:

Value	Description
[0,0.2]	
<0.2,0.4]	
<0.4,0.6]	
<0.6,0.7]	
<0.7,0.8]	
<0.8,0.9]	
<0.9,1]	

Figure 3.1 Class definition for the Chara spp spatial statistics model

15. **Add another statistics model for HSI_Chara_Total_Scen**

16. **Add two spatial statistics models for the herbivorous water birds**
    – Add values as depicted below.

Value	Description
0	Land
10	Geese, swimmimg ducks
20	Swimming ducks, geese, swans
30	Swans
40	Diving ducks
50	Not available for birds
60	No macrophytes

Figure 3.2 Class definition for the herbivorous bird spatial statistics model

17. **Run the scenario "Difference"**

It is possible to copy the results of statistics to Excel to make figures of the results. Select the data and click 'ctrl+c', open Excel and paste with 'ctrl+v' in Excel. Moreover, you can link Excel to the calculated asci files.

Pay attention to the fact that HABITAT uses a comma as deliminator.

18. **Fill in the table below based on the results**

	current situation	island and lower water level
HSI	area (ha)	area (ha)
0		
<0,0.2]		
<0.2,0.4]		
<0.4,0.6]		
<0.6,0.7]		
<0.7,0.8]		
<0.8,0.9]		
<0.9,1]		

	current situation	island and lower water level
HSI	area (ha)	area (ha)
0		
10		
20		
30		
40		
50		
60		

19. Which water depth is preferable when you want to establish large fields of *Chara spp.*?

20. Regarding food availability for herbivorous birds: which of the two calculations show the highest food availability?

Optional

21. Run another calculation with a change in water level.

– Try to create an input map of the water depth that has a different water level than the maps used in these scenarios.

22. Save and close your project

4 Exercise 3: Ecotope classification

An ecotope classification is a functional classification of an area based on abiotic and biotic environmental conditions. In this exercise you will make an ecotope classification and run this for an imaginary case and for the Westerschelde. In this exercise we will make an ecotope classification with HABITAT based on the criteria in Table 4.1. We will use two input maps from two different areas: an imaginary case and the 'Westerschelde', which is an estuary in the South of the Netherlands.

Table 4.1 Simple ecotope classification

Ecotope Number	Ecotope	Salt content (ppt)	Depth (cm NAP)
1	Intertidal area, brackish	0 t/m 20	-200 t/m 200
2	Intertidal area, salt	20 t/m 35	-200 t/m 200
3	Shallow water, brackish	0 t/m 20	-500 t/m -200
4	Shallow water, salt	20 t/m 35	-500 t/m -200
5	Channel, brackish	0 t/m 20	< -500
6	Channel, salt	20 t/m 35	< -500

HABITAT uses so-called *.bil format maps as input that are accompanied with a *.hdr file. The bil format is a binary form of an asci-grid file. The header of the asci file exists of lines indicating the amount of columns and rows (ncols en nrows), the coordinates of the lower left corner of the grid (xllcorner en yllcorner), the cell size and the value used for missing data (nodata value). This information can be found in the *.hdr file (useful to check grid size and coordinates).

Example of an ascii-gridfile:

```
ncols         3
nrows         3
xllcorner     0.0
yllcorner     0.0
cellsize      100.00
nodata_value  -999
100    -310  0
-400   -200  -1050
-999   -310  -3000
```

The input maps for the water depth and salt content for the imaginary case, called 'Bak', are given in the folder: **Data_Exercise3**. 'Bak' exists of 9 raster cells of 100 m × 100 m. In Figure 4.1 the cell values of the two input maps are depicted.

10.3	18	25.3
12	25.9	19
14	30	30

100	-310	0
-400	-200	-1050
-999	-310	-3000

Figure 4.1 Salt content (left, ppt) and water depth (right, m, positive values indicate the depth) values for the imaginary case "Bakje". NB: -999 is a missing value.

4.1 Imaginary case 'Bakje'

4.1.1 Preparation

1. **Open HABITAT**

2. **Add a folder**
   – Select from the 'File' menu or right click with mouse in the Project Explorer

3. **Rename the folder**.
   – Change the name of the folder to Exercise 3.

4. **Add a scenario**
   – Right click or via 'File" menu

5. **Rename the scenario**
   – Rename the scenario to "Ecotope Classification Bakje"**.**

6. **Add a multiple reclassification model**
   – Right click or via 'File" menu

7. **Rename the model**
   – Use "Estuary Ecotopes".

8. **Save your project**
   – Use for example "Habitat Exercise3"

9. **Define input maps:**
   – Add the salt content (Zout_Bak) and water depth (Diepte_Bak) maps to the "Estuary Ecotopes" model. Data can be found in: **Data_Exercise3\Bak**

10. **Fill in multiple classification table**
    – Use Table 4.1 to fill in the classification table. It is possible to copy and paste cells or rows, with right click at a cell or row and select copy or paste from the menu.

11. **Insert output name**
    – Use for instance "Ecotope Bakje"

It is not possible to use a '-' sign in a variable name (map name). 'map-name' will be read as: calculate variable 'map' minus variable 'name'. Use underscore ('_') in stead of '-'. The same accounts for other mathematic signs like:

'*' or 'x' which mean multiply
'^' which indicates square
'exp' indicates exponent

12. **Visualise input maps**:
    – Double click in the Project Explorer at the input maps.

13. **Change the legends of the input maps**
    – When having the window with the figure of the water depth in the “Working Window”, right click at “Diepte_Bak” in the “Map Contents” window. Choose properties and edit the legend as depicted below.

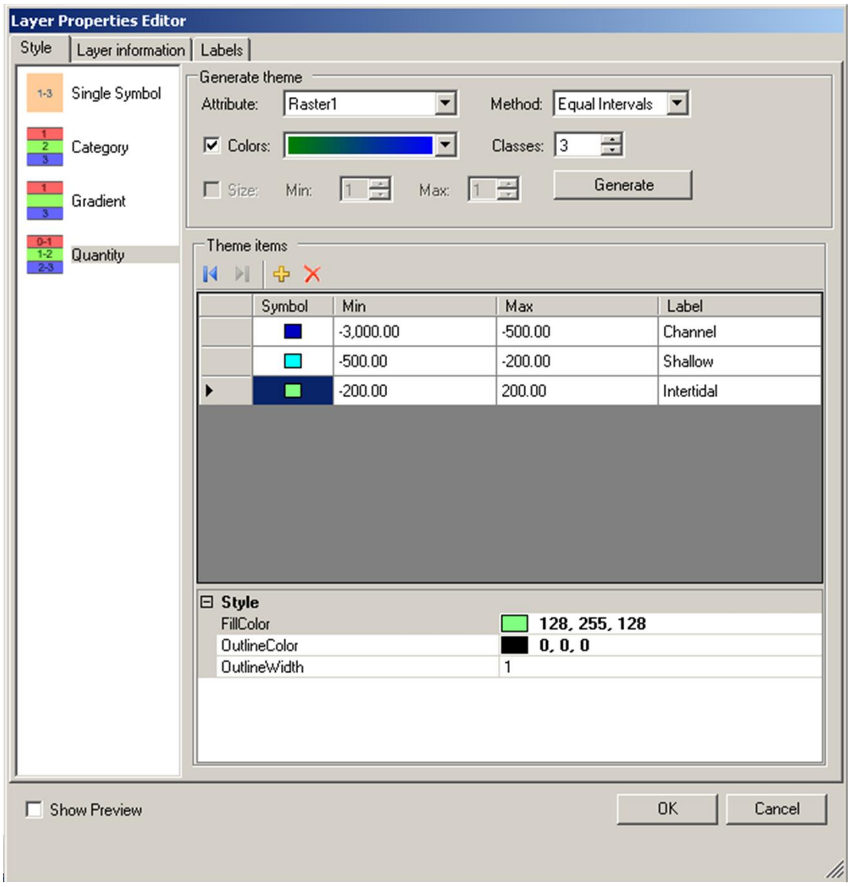


Figure 4.2 Legend of “Diepte_Bak.bil” according to table 4.1.

– Do the same for Salinity, using Table 4.1.

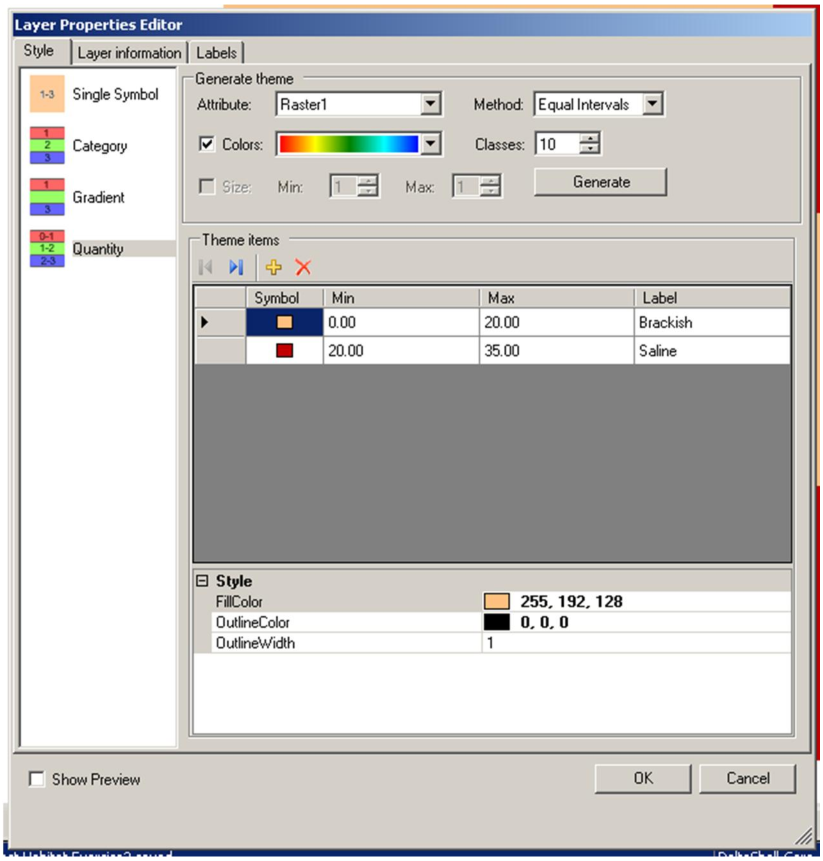


Figure 4.3 Legend of "Zout_Bak.bil" according to table 4.1

Using proper legends help to get a clue about your input maps and what you may expect from the actual reclassification action.

14. **Save the project**

15. **Run the Reclassification Table model**

16. **Open the output map**

17. **Change the legend as depicted in the figure below**

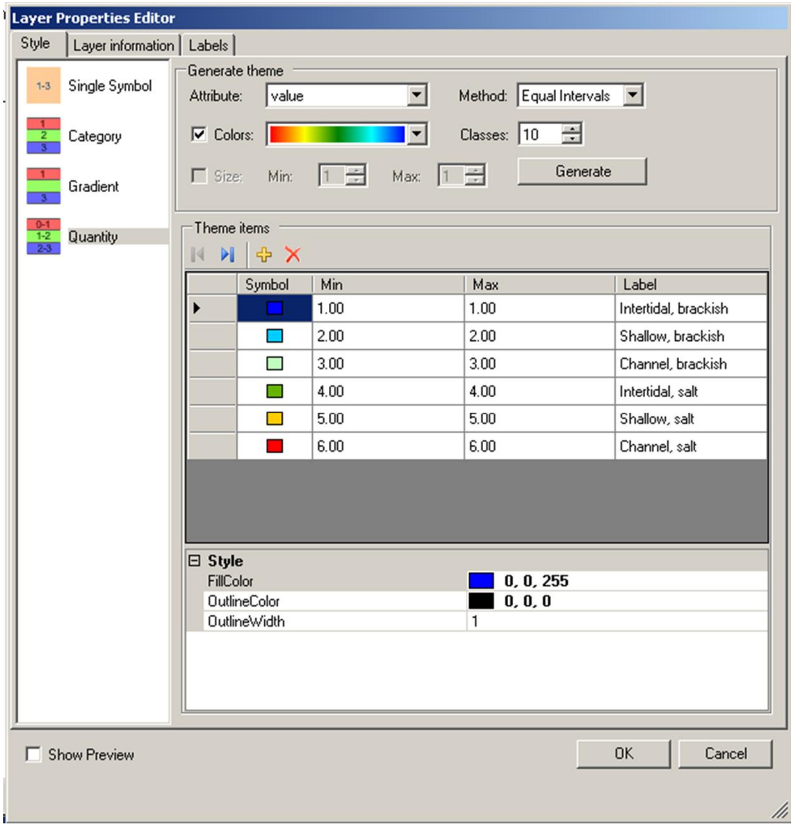


Figure 4.4 Legend for the ecotope classification output map.

18. **Save the legend**
   – Export the legend as “Ecotope.dsleg” in order to use the same legend for the Westerschelde case

Store the legends in a handy place, so you can find them easily when needed.

19. **Analyse the outputs**
   – Check whether the results are what you expected (arrange windows or put layers on top of each other).

4.2 Westerschelde case

The two input maps for the Westerschelde (salt content and depth) can be fount at: **Data_Exercise3\Westerschelde.** The grid size of the Westerschelde maps are 25 x 25 m.

20. Do the same as for the imaginary "Bakje" case

21. Make legends for the input maps

- Make legends such that you can more or less reconstruct figures Figure 4.5 and Figure 4.6. **Hint:** red colours indicate high salinity (salinity map) or land (water depth).

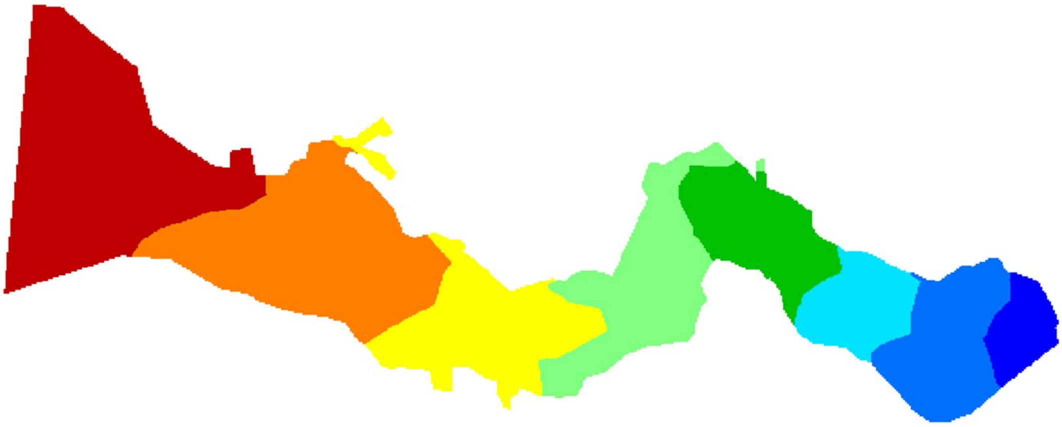


Figure 4.5 Salinity map of the Westerschelde (ppt).

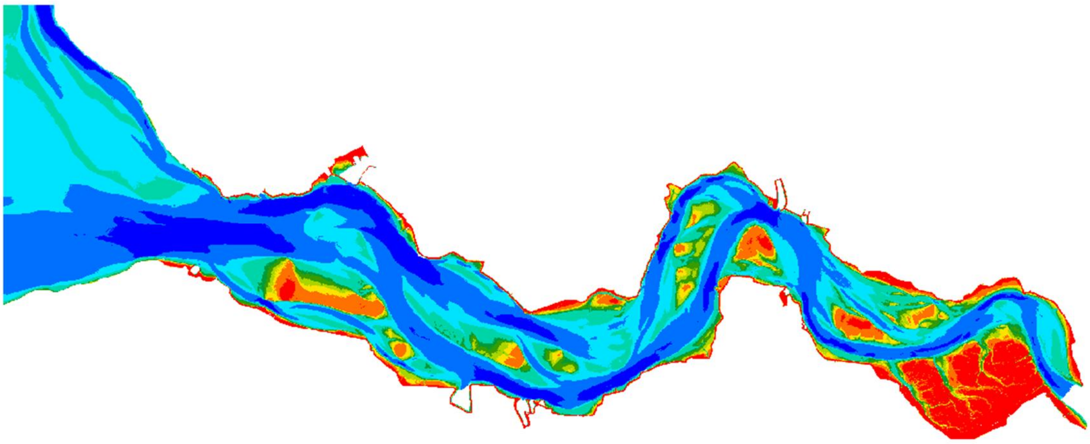


Figure 4.6 Water depth map of the Westerschelde (cm).

22. Import legend

After running your model, open your output map and add the exported legend of the imaginary case to the output map, it should look like Figure 4.7.

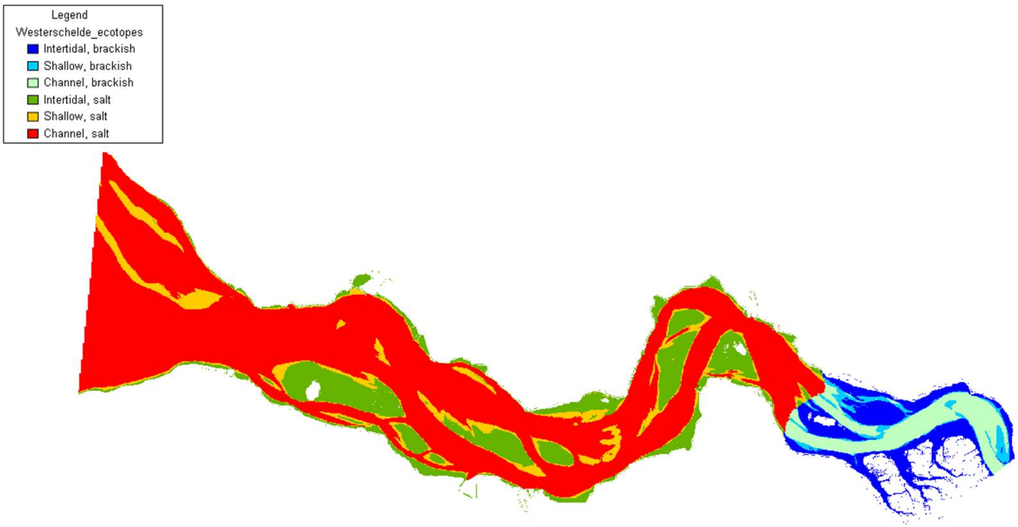


Figure 4.7 Ecotope map of the Westerschelde

23. Add a spatial statistics model

– Change the name of the model to "Stat Ecotope WS".

24. Open the model

25. Link the Westerschelde ecotope map to the input grid

26. Define statistics

– Use the earlier defined ecotopes as classes ("Intertidal area, brackish", "Channel, salt" etc)

27. Run spatial statistics

28. Analyse the results

– What is the total area of the Westerschelde?
– What is the minimum and maximum value of the ecotope map?
– What is the area of the intertidal ecotopes (ha and %)

29. Save the project and exit HABITAT….and relax!