

# Exercise One: Creating A Raster Data Layer Of Water Depth

In the marine environment, water depth is one of the most important variables that controls the distribution of many species. As a result, it is often important to be able to incorporate water depth into a GIS project. In paper charts, water depth information is usually provided either as depth contours, which link areas of the same water depth, or as the depth values for specific points. While such information is useful for creating maps in GIS, it is often more useful to have depth information as a continuous surface. This is because it provides information on water depths at every point within a specific study area and not just at some locations. One of the most common ways to create a continuous surface of water depth in a GIS is to convert depth contours or point data into a raster data layer using an interpolation tool. Such tools estimate the water depth in each grid cell within the raster data layer based on its position relative to the depth contours or point data.

Therefore, in this exercise, you will create a raster data layer of water depth for a study area in the northern North Sea from a line data layer of depth contours. However, once you have created this raster, you will notice that the tool used to create it also interpolates values for areas that are on land. As a result, you will also create a mask and use it to remove all the cells that are on land. Thus, your final depth raster data layer will only contain cells that are in the sea. This is particularly important to do if you are going to derive further topographic raster data layers, such as one for the slope of the seabed, from your depth raster data layer (see exercise two).

Before you start this exercise, you will first need to create a new folder on your C: drive called GIS\_EXERCISES\_2. To do this on a computer with the Windows 7 operating system, click on the START menu and select MY COMPUTER. In the window which opens, double-click on the icon for your C: drive (this may be called WINDOWS (C:)). This will open a window which displays the contents of your C: drive. To create a new

folder, right click on this window and select NEW> FOLDER. This will create a new folder. Now call this folder GIS\_EXERCISES\_2 by typing this into the folder name to replace what it is currently called (which will most likely be NEW FOLDER). This folder, which has the address C:\GIS\_EXERCISES\_2, will be used to store all files and data for the exercises in this book.

Next, you need to download the source files for two data layers from [www.gisinecology.com/books/data/marinebiologyworkbook](http://www.gisinecology.com/books/data/marinebiologyworkbook). When you download these files, save them into the folder C:\GIS\_EXERCISES\_2 which you have just created. These data layers are:

**1. Depth\_North\_Sea:** This is a line data layer which contains information on water depth. You will need to download all the files called Depth\_North\_Sea (each with a different extension) in order to be able to use it. This data layer is in the geographic projection and uses the WGS 1984 datum. **NOTE:** The depth values are not accurate and are only provided here as an approximation for illustration purposes. As a result, it should not be used for any purpose other than these exercises.

**2. Land\_North\_Sea:** This is a polygon data layer which contains information on land in this region. You will need to download all the files called Land\_North\_Sea (each with a different extension) in order to be able to use it. This data layer is in the geographic projection and uses the WGS 1984 datum. **NOTE:** The land information is not accurate and is only provided here as an approximation for illustration purposes. As a result, it should not be used for any purpose other than these exercises.

Once you have these files downloaded into the correct folder on your computer, and once you understand what is contained within each file, you can start this exercise by creating a blank GIS project. To do this, start the ArcGIS software by opening the ArcMap module. When it opens, you will be presented with a window which has the heading ARCMAP – GETTING STARTED. In this window you can either select an existing GIS project to work on, or create a new one. To create a new blank GIS project, click on NEW MAPS in the directory tree on the left hand side and then select BLANK MAP in the right hand section of the window. Now, click OPEN at the bottom of this window. This will open a

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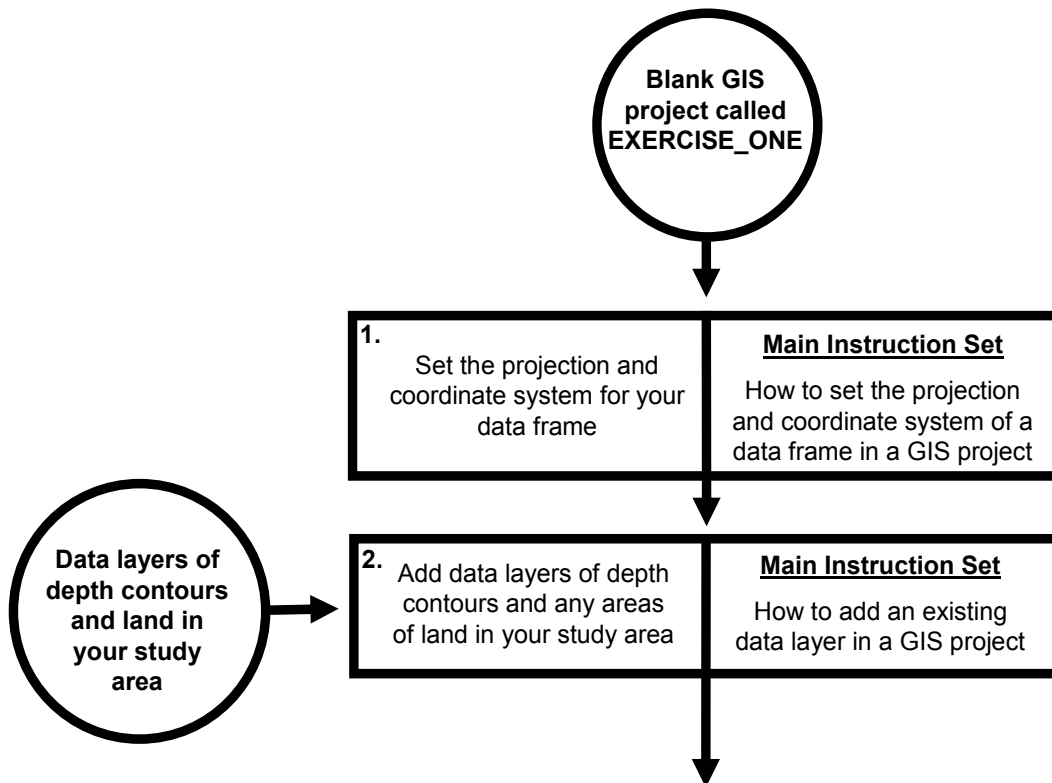
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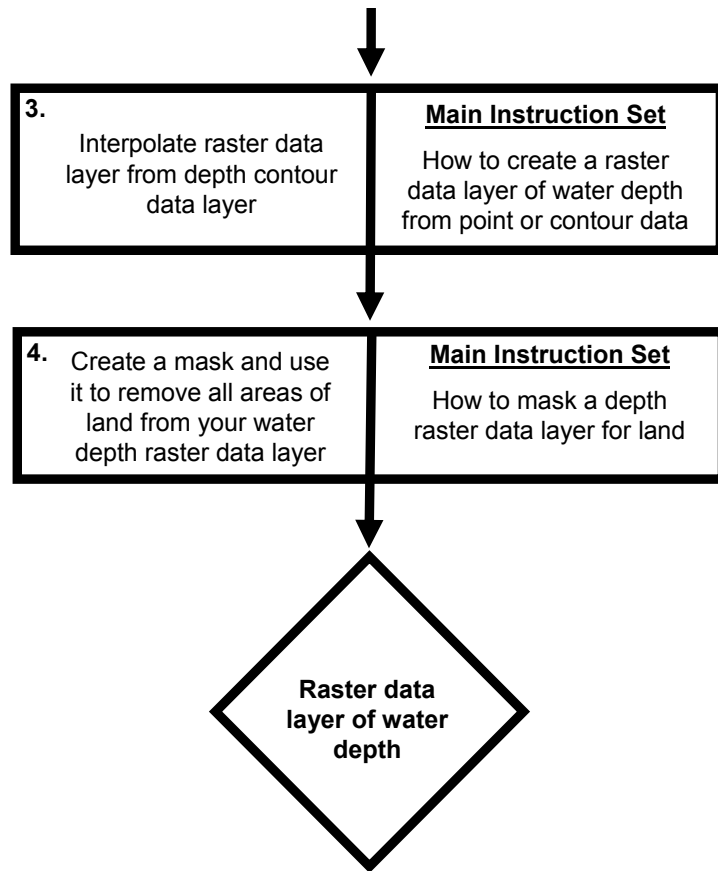
new blank GIS project. (**NOTE:** If this window does not appear, you can start a new project by clicking on FILE from the main menu bar area, and selecting NEW. When the NEW DOCUMENT window opens, select NEW MAPS and then BLANK MAP in the order outlined above.)

Once you have opened your new GIS project, the first thing you need to do is save it under a new, and meaningful, name. To do this, click on FILE from the main menu bar area, and select SAVE AS. Save it as EXERCISE\_ONE in the folder C:\GIS\_EXERCISES\_2.

The next step is to read over the summary flow diagram for this exercise. This will help you identify all major steps you need to carry out and the individual instruction sets you will need to follow to do them. The summary flow diagram for this exercise is provided on the next two pages.

*Summary Flow Diagram For Creating A Raster Data Layer Of Water Depth*





Once you have familiarised yourself with the summary flow diagram outlining the major steps you will need to complete, and which instruction sets can be used to complete them, you need to read through the instruction set for the first step in the flow diagram in its entirety (see below), before working through it step by step. Once you have completed the first step, read through the instructions again to check that you have completed it properly. It is important to do this at this stage as you need to use the results of one step as the starting point for the next. This is because it is much easier to spot where you have gone wrong at the end of an individual step, rather trying to work it out later when you get stuck as a result of a mistake made at this stage. Once you have completed the first step, move onto the second step and repeat this process, and so on until you have completed all the steps in the summary flow diagram.

At various points throughout the exercise, images of the contents of the MAP window, the LAYOUT window, the TABLE OF CONTENTS window and/or the TABLE window

will be provided so that you have an idea of what your project should look like at that specific point. Check your GIS project against these images. If they do not match up, you will need to go back and work out where you have gone wrong.

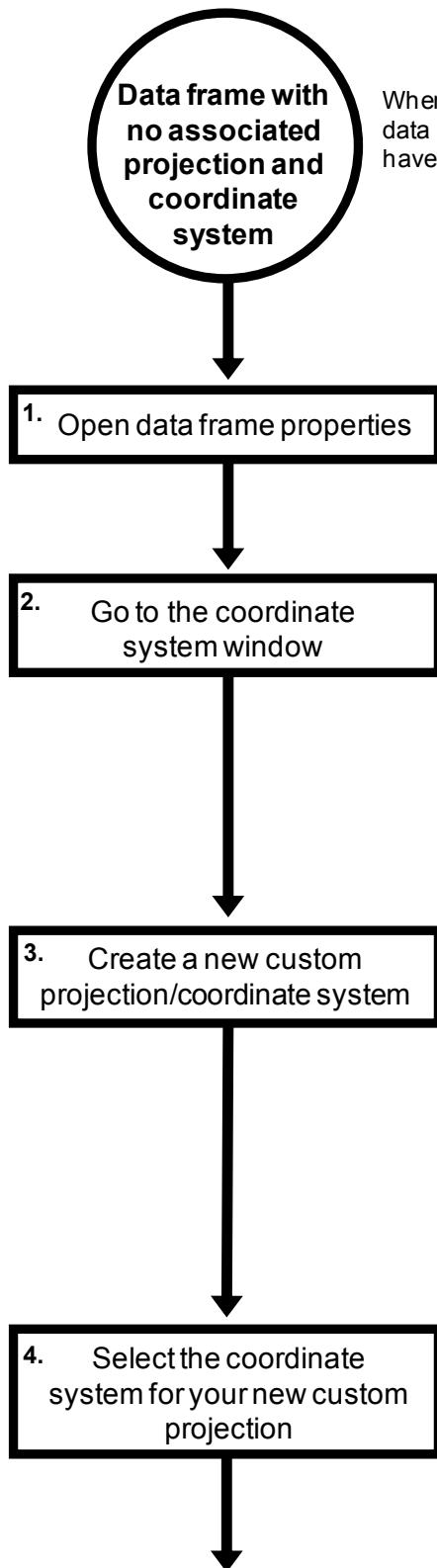
**NOTE:** It is important that you save your GIS project after you complete each step. This can be done by going to the FILE menu on the main menu bar and selecting SAVE.

### **Instruction Sets For The Individual Steps Identified In The Summary Flow Diagram:**

#### **STEP 1: SET THE PROJECTION AND COORDINATE SYSTEM OF YOUR DATA FRAME:**

These instructions are based on the instruction set *How to set the projection and coordinate system for a data frame in a GIS project* (from *An Introduction To Using GIS In Marine Biology*). For this exercise, the projection and coordinate system will be set to a custom transverse mercator centred on the middle of the area of data collection. This central position is latitude 56.5°N and longitude 1.0°W (or latitude 56.5° and longitude -1.0° in decimal degrees). This projection was chosen as it provides an accurate representation of the shape and relative positions of features in the study area. In addition, it can also be used to accurately measure distances and areas in real world units, which will be important for later exercises. This custom transverse mercator projection will use the WGS 1984 datum. This datum is used because it is the same as that used during data collection and for the existing data layers.

The flow diagram for this step starts at the top of the next page.



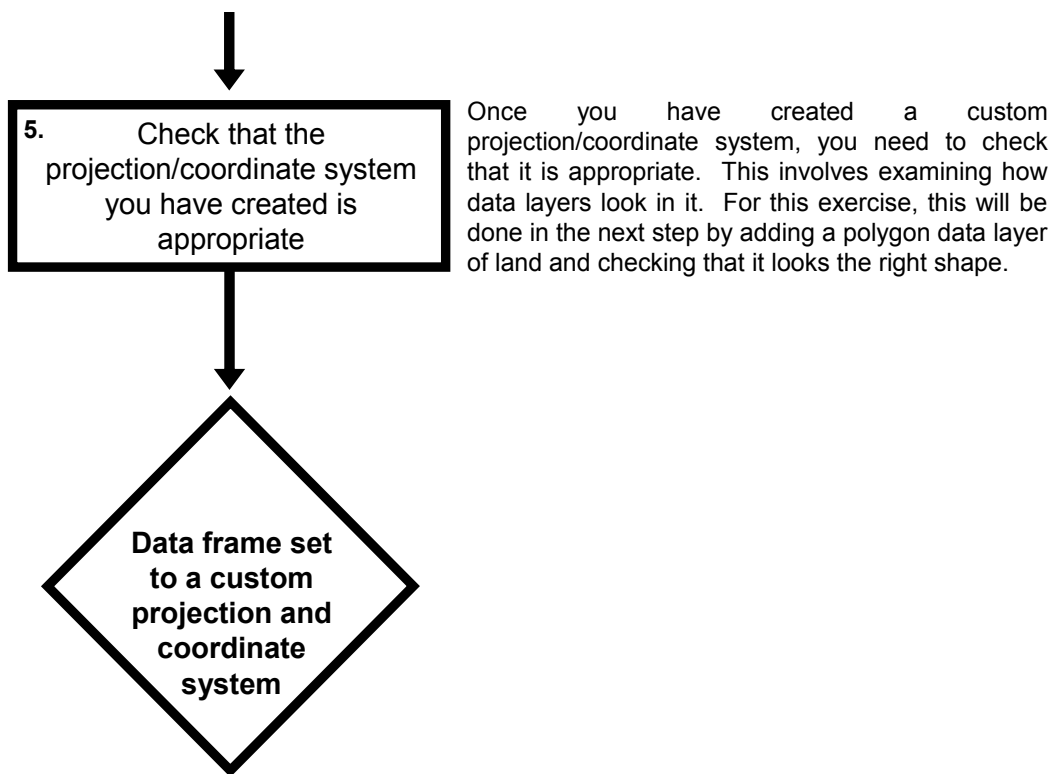
When you open a new GIS project, there will be an empty data frame (called, rather confusingly, LAYERS). It will not have a projection or coordinate system associated with it

To open the properties of a data frame, right click on its name (in this case LAYERS) in the TABLE OF CONTENTS window, and select the PROPERTIES option. If the TABLE OF CONTENTS window is not visible, go to the WINDOWS menus and click on the TABLE OF CONTENTS option.

Select the COORDINATE SYSTEM tab in the DATA FRAME PROPERTIES window. The lower section of this window will tell you which projection and coordinate system are set for the data frame you are currently using. This should currently say 'No coordinate system'.

To create a new custom projection/coordinate system, click the ADD COORDINATE SYSTEM button that can be found towards the top right hand corner of the COORDINATE SYSTEM tab (it has a picture of a globe on it), and select NEW> PROJECTED COORDINATE SYSTEM. This will open the NEW PROJECTED COORDINATE SYSTEM window. In the upper NAME window, type in NORTH SEA. In the PROJECTION portion of the window, select the name of the appropriate type of coordinate system from the drop down menu (in the lower NAME window). For this exercise, select TRANSVERSE MERCATOR. Next type in the values you wish to use for the parameters. LATITUDE\_OF\_ORIGIN enter 56.5. For CENTRAL\_MERIDIAN enter -1.0. Leave all other sections of the window with their default settings.

In the GEOGRAPHIC COORDINATE SYSTEM section of the PROJECTED COORDINATE SYSTEM window, by default it should say NAME: GCS\_WGS\_1984. If it doesn't, click on the CHANGE button and type WGS 1984 into the SEARCH box in the window that appears before pressing the return key on your keyboard. Select WORLD> WGS 1984, and click the OK button. Now click the OK button in the NEW PROJECTED COORDINATE SYSTEM window. Finally, click OK in the DATAFRAME PROPERTIES window.



To check that you have done this step properly, right click on the name of your data frame (LAYERS) in the TABLE OF CONTENTS window and select PROPERTIES. Click on the COORDINATE SYSTEM tab of the DATA FRAME PROPERTIES window and make sure that contents of the CURRENT COORDINATE SYSTEM section of the window has the following text at the top of it:

North Sea  
Authority: Custom  
Projection: Transverse\_Mercator  
False\_Easting: 0.0  
False\_Northing: 0.0  
Central\_Meridian: -1.0  
Scale\_Factor: 1.0  
Latitude\_Of\_Origin: 56.5  
Linear Unit: Meter (1.0)

If it does not, you will need to repeat this step until you have assigned the correct projection/coordinate system to your data frame.