

SCIMAP-S: Course Notes

Sensitive Catchment Integrated Modelling and Analysis Platform - for fine Sediment risks

Introducing SCIMAP, what is it and how will I use it?

See separate slide handout

Platforms

We will use two software platforms over the next two days:

SAGA – System for Automated Geoscientific Analyses- is a freely available platform for implementing geoscientific methods; with full and free access to the source code for current modules and the ability to develop new modules in C++. It was developed in Göttingen, Germany by R. Köthe, O. Conrad, A. Ringeler & J. Böhner and is available from: www.saga-gis.org SCIMAP has been developed by us as a module within SAGA allowing us to freely distribute it.

ArcGIS – is a suite of geographic information system (GIS) software products produced by ESRI. We will be using ArcInfo which includes capabilities for data visualisation, manipulation, editing and analysis. We will use ArcGIS initially to prepare the data then for visualisation since these tasks are much more difficult within SAGA.

Data

We will use **Land Cover data** from the CORINE Land Cover Map for 2000, produced jointly by the European Commission and the Member States. It is designed to be used at a scale of 1:100,000 and has a minimum mappable unit of 25 ha. It records 44 land cover and land use classes which represent the major surface types across Europe. The UK part of the map was produced by generalising a more detailed national map (LCM2000 which is also suitable for SCIMAP and available from CEH but is not free). The CORINE data can be downloaded from: <http://www.eea.europa.eu/themes/landuse/clc-download>

We use **Annual Average Rainfall Data** that are based on the UKCIP 2008 baseline data freely available from the Met Office.

We need **Topographic Data** of a resolution of 10 m or finer. Two potential sources of this data are:

1) NEXTMAP DTM data from Intermap <http://www.intermap.com/right.php/pid/4/sid/328>

The data have a resolution of 5 m and an elevation error of ~1 m they currently cost ~£10.50 per km². These data are very suitable for use in SCIMAP. Mark Stanley is the Director of United Kingdom Sales his details are Tel: 01491 671933 Email: mstanley@intermap.com

2) OS Landform Profile DTM data from the Ordnance Survey

<http://www.ordnancesurvey.co.uk/oswebsite/products/landformprofile/>

The data have a resolution of 10 m and an elevation error ~1.8 m their cost is closely related to the size of the area you are purchasing but is significantly lower than that for NEXTMAP data. There are also discounts for “non-corporate users”, which may make profile data quite reasonable. You would need to buy the Data direct from the OS and note it is definitely the profile not the profile+ that you are after and the DTM rather than the contour data. For enquiries about OS data the general enquiry line is 08456 050505 my contact there was Mark Aston 02380 305520

Running SCIMAP Session 1: Defining your catchment and preparing your data

Overview

We will be using a system called SAGA a freely available GIS code called – note, please, this is not GIS for old people, as some people have called it – but a piece of software that the developers have made free to download – celebrate their philanthropy before you make jokes about their unfortunate choice of name. By the end of Session 1, we want to be ready to go start SCIMAP. Note though, we don't suggest you download SAGA yourselves, as we will supply a version of SAGA with SCIMAP in it.

Aims of Session 1.


1. Identify our catchment boundary (Steps A to I)
2. Use the catchment boundary to cut out our data on topography, land cover, and rainfall (Steps J to M)

Guide to what steps to do:

If you don't know your catchment outline, do all steps

If you have a catchment outline (in the form *.shp), go to Step G

Step A. We need to get access to our data and read it into the software platform, start SAGA and Load Grids. To load the grids we need them in a very simple but extremely inefficient data system called ascii (American Standard Code for Information Interchange, for the nerds amongst you). The Landcover (CORINE) and rainfall data are already available in ascii format for the entire of England and Wales for you to use. You need to request the topographic data from your data provider as a single ArcGIS ascii file in Ordnance Survey Grid (the projection used for UK maps).

A1. In the 'My Computer' window navigate to your workspace then open the folder SAGA2.0 then double click on saga_gui.exe (it will display with this icon )

Saga will open and you may see a SAGA error "failed to load shared library..." don't worry about this since it refers to tools that are surplus to our requirements. Click **OK**

A2. Next we want to close any open grids

Go to the **Data** tab at the bottom of the **Workspace** right click on **Grids** choose **close** then **Yes**

A3. In the *Modules* tab click *Import/Export – Grids* then double click on *Import ESRI Arc/Info Grid*

Click in the box to the right of *File* then click on the *...* icon (this is the same as the folder icon in ARC or windows). Navigate to the location where your data are stored e.g. *F:\SCIMAP\Demo_Data* select the topography raster that you want to import (note that it will have a .asc extension).

e.g. *[catchmentname]_dtm_10.asc*

Click *Open*, Click *Okay*

A4. Go to *Data* tab and double left click on each of these to check that they have imported properly and that they look right.

A5. Resample the topographic data so that the cell size for the raster is 50 m. Note for this stage we are going to work with a very coarse resolution – 50 m – this is fine for what we are doing in this Session – but not for SCIMAP itself

In the *Modules* tab click *Grid – Tools* then double click on *Resampling*

Click in the box to the right of *Grid system* choose the long string of numbers. This box is telling the software about which dataset you are going to work with, because we have only loaded one dataset there is only one option which makes things much simpler. The numbers tell the software the cellsize; no of columns and rows; OS grid coordinates of the lower left corner.

Click in the box to the right of *>> Grid* choose your topography raster

e.g. *[catchmentname]_dtm_10*

(note the *>>* sign indicates a compulsory input, a *>* sign would be an optional input, a *<<* is compulsory output and a *<* is an optional output)

Under *Options*

Click in the box to the right of *Target Grid* and select *specify dimensions* (allows you to specify the new cell size in the current grid units. The resulting grid will cover the same area but with a different number of cells)

Click *Okay*

A new window called *Target Grid Dimensions* appears click in the box to the right of *Cell Size* and alter the value to *50* (this will resample the topography raster to a 50 meter cellsize).

Press *Enter* you will notice that the boxes to the right of Cell Count: Columns and Rows update themselves.

Click *Okay*

A new window called *Up-Scaling* appears click in the box to the right of *Interpolation Method* and choose *Mean Value*. This method should be used to calculate the values of cells in a grid

when the cellsize has been increased. The space in the new grid occupied by one cell was occupied by more than one cell in the original grid, this method simply takes the mean of the cells that previously occupied the space.

When the process is completed (i.e. blue progress bar disappears and you hear a beep). Click on the *Data* tab at the bottom of the *Workspace* to check the new data looks right. Under Grids you will now see two long strings of numbers both with the same topographic data (e.g. [\[catchmentname\]_dtm_10](#)) underneath them. However, their cellsize will be different. You will be able to tell this from the first number in the string. For the original dataset it will be a 10 for the resampled dataset it will be a 50.

Step B. Now we have our data we need to deal with a little problem – hydrological analysis requires water to flow down hill.

So, we will fill the DEM

B1. In the *Modules* tab click *Terrain Analysis - Preprocessing* then double click on *Fill Sinks (Planchon/Darboux, 2001)*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Grid* choose your topography raster

e.g. [\[catchmentname\]_dtm_10](#)

Click in the box to the right of *<< Filled DEM* and select [\[create\]](#) (this will create a new grid as an output)

Click *Okay*

This may take a bit of time

Step C. Now our water can all flow downhill, we have to decide how it would like to do that. Imagine you are a point in the river – we have to work out where upstream the water that flows past you could have come from – when we know this – we know the area upstream that has contributed to you (your upstream or upslope contributing area) – this is, by definition, your catchment outline

Some discussion ... and some notes *How does water flow down a hillslope?*

So, we will generate the flow direction using D8 – note – in SAGA – there are better options – but using D8 gives a very good and rapid and probably sufficient catchment outline for our purposes

C1. In the *Modules* tab click *Terrain Analysis – Hydrology* then double click on *Parallel Processing*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Elevation* choose your filled topography raster

e.g. *Filled DEM*

You can leave *> Sink Routes* and *> Weight* as *[not set]*

Make sure that *<< Catchment Area* is set to *[create]*

You can leave *< Catchment Slope*, *< Catchment Aspect* and *< Flow Path Length* as *[not set]*

Under *Options*

Click in the box to the right of *Method* and select *Deterministic 8 (D8)*

Leave the other options set as their default values

Click *Okay*

When the process is completed click on the *Data* tab at the bottom of the *Workspace*, double click on *Catchment Area* and choose the top existing Map, click *OK*. The catchment area will display, maximise the window.

Step E. We now have to tell the computer, which struggles to understand our desires at the best of times, where we want to focus on downstream – the outlet of our catchment – which we call the pour point – note we are introducing a new sort of GIS data here – vector data (the other sort being raster data)

Some discussion ... and space for notes

C1. In the *Modules* tab click *Shapes - Tools* then double click on *Create Empty Shapes Layer*

Make sure that *<< Shapes* is set to *[create]*

Under *Options*


Click in the box to the right of *Name* delete the text 'new shapes layer' and replace it with a name for your catchment outlet point (e.g. *[catchmentname]_pour1*)


Make sure that *Shapes Type* is set to *Point*


Click *Okay*

When the process is completed click on the *Data* tab at the bottom of the *Workspace*, there will be a new *Shapes* item in the Workspace box, double click on the new point dataset (e.g. *[catchmentname]_pour1*) choose the top existing Map, click *OK*.

Right click on the new point dataset (e.g. *[catchmentname]_pour1*) and select *Edit* then *Add Shape*.

Highlight the Catchment Area grid in the Workspace box then click on the Zoom to Selection icon () the catchment area grid will come back into view.

Zoom to the area where you want to locate your catchment outlet using the zoom tool  which can be used to zoom in by left clicking, zoom out by right clicking and zoom to a given area by left clicking then dragging to create a box defining your area of interest. Zoom right in on the reach of the river that you want to use as your catchment outlet until you can see the values of the cells in the display window.

Click on the Action tool  select the new point dataset (e.g. [catchmentname]_pour1) in the Workspace box by single clicking on it (**NB making sure the shapefile is selected is important, it will not work otherwise!**). Move the cursor back over the display window and left click in the centre of the cell that you want to use as your catchment outlet. You will see a white box with a white cross appear where you have clicked.

NOTE: If you are working with the EDEN example please choose a subcatchment to the river Eden rather than the entire catchment since the computer will take a very long time to perform the calculations on the entire catchment. You might instead choose a subcatchment like those in the table below.

LOCATION	EASTINGS	NORTHINGS
River Eden	360460	528330
River Eamont	357570	530450
River Irthing	348650	558110
River Petteril	341190	554500
River Caldw	339480	552730

Right click in the display window and uncheck *Edit Selected Shape* then click *Yes* to save changes. You will now see a green dot where you defined your outlet.

In the *Modules* tab click *Grid - Gridding* then double click on *Shapes to Grid*

Click in the box to the right of *>> Shapes* choose the outlet point dataset (e.g. [catchmentname]_pour1)

Click in the box to the right of *Attribute* choose *Name*

Click in the box to the right of *Target Dimensions* choose the *Grid Project*

You can leave *Method for Lines* as it is.

Click *Okay*

A new window called *Choose Grid Project* appears click in the box to the right of *System* and this time choose the grid system for the resampled data (i.e. the one that starts with a 50)

You can leave *Target Grid Type* as it is.

Click *Okay*

In the *Modules* tab click *Grid – Tools* then double click on *Change Grid Values*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Grid* choose your newly created catchment outlet raster

e.g. [catchmentname]_pour1

Click in the box to the right of *< Changed Grid* and select [not set] (this will change the input grid rather than creating a new output).

Make sure the *Replace condition* is set to Grid value equals low value

Click in the box to the right of *Lookup Table* then click on the *...* icon, in the *low value* column type 1 and in the *replace with* column type -1 in all the rows.

Click *Okay*, Click *Okay*

Step F. Finally, and remembering that in most GIS, you have to take a lot of steps to get to what you actually want to do, we can work out our catchment outline – like most partners/wives/husbands, ARC doesn't always do what you want it to do at this stage – so you may have to go back and repeat Step E, making sure you find a big upslope contributing area

In the *Modules* tab click *Terrain Analysis - Channels* then double click on *Watershed Basins*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Elevation* choose your filled topography raster

e.g. [catchmentname]_dtmf_10

Click in the box to the right of *>> Channel Network* choose the outlet raster

e.g. [catchmentname]_pour1

We can use a pour point raster with a single cell that has the value -1 here rather than a channel network because -1 is the trigger value for calculating the catchment to that point.

Make sure that *<< Watershed Basins* is set to [create]

Click *Okay*

When the process is completed the result will be one single catchment with its outlet at the point that you defined earlier. We can check this by going to the *Data* tab, then double clicking on the new Watershed Grid (e.g. *Watershed Basins*) and choosing the top existing Map, clicking *OK*.

Step G. When we go on to do processing with our catchment outline, the software gets most distressed if it doesn't have a cushion to soften the calculations at the edges – in short – it will crash – so we add in a bit more data around the catchment edge to stop this happening – this does not impact on your calculations at all – but makes the computer feel much better about it

In the *Modules* tab click *Grid - Tools* then double click on *Grid Buffer*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Features Grid* choose your catchment outline raster

e.g. [Watershed Basins](#)

Click in the box to the right of *<< Buffer Grid* choose [\[create\]](#)

Under Options

Click in the box to the right of *Distance* and type 100 (this is the buffer size in meters)

Leave the Buffer distance as fixed.

Step H. Step G has worked out our catchment outline and added a buffer to it, but the data it is handling are in a raster format – we need to convert this back to a vector format

In the *Modules* tab click *Shapes – Grid* then double click on *Vectorising Grid Classes*

Click in the box to the right of *Grid system* choose the grid system for the resampled data (i.e. the one that starts with a 50)

Click in the box to the right of *>> Input Grid* choose your watershed grid

e.g. [Watershed Basins](#)

Make sure that *<< Shapes* is set to [\[create\]](#)

Make sure that the *Output as...* option is set to *Polygons*

Click *Okay*

Now we need to bring the original elevation data back in and clip it to the new catchment area.

In the *Modules* tab click *Shapes – Grid* then double click on *Clip Grid with Polygon*

Click in the box to the right of *Grid system* this time we want to choose the grid system for the **Original data** (i.e. the one that starts with a 10)

Click in the box to the right of *>> Input* choose your topography grid

e.g. [\[catchmentname\]_dtm_10](#)

Click in the box to the right of *>> Polygons* choose your watershed polygon

e.g. [Watershed Basins](#)

Click *Okay*

Step J. Now we have a catchment boundary, we need to get our data cut down to size – as defined by the catchment boundary

J1. No greedy capitalists behind this one – the CORINE land use data are free! Add the CORINE landcover map for the whole of the UK from the location where your data are stored e.g. F:\SCIMAP\Demo_Data. Add the data using the same method as you used for the topographic data at the start of this session (step A3).

J2. Is the Met Office missing a trick here – rainfall data are also free (but then the Met Office is funded by tax payer's money – shame it wasn't the EA that commissioned NEXTMAP data)! Add the Rainfall map for the whole of the UK from the location where your data are stored e.g. F:\SCIMAP\Demo_Data. Add the data using the same method as you used for the topographic data at the start of this session (step A3).

Step K. We have our data, so now let's get the scissors out, starting with the rain data – and in here there is a critical trick – we have to get the rain (5 km) data onto the same resolution as the topography (10 m in this application) – note the alert amongst you might think this means you could use coarser resolution topography and do the same trick – no such luck – as annually-averaged rainfall doesn't have that much of a spatial variability, so you can make it finer (if you don't believe us, try lying down, outside, for a year, and seeing if you think your head is wetter than your toes at the end of it) – topography is more complex

In the *Modules* tab click *Grid – Tools* then double click on *Resampling*

Click in the box to the right of *Grid system* choose the grid system for the rainfall data this will be the one that starts with a 5000 because the rainfall data is at 5km resolution.

Click in the box to the right of *>> Grid* choose the rainfall data (it should be the only option)

e.g. [UK_rain_5km](#)

Under *Options*

Click in the box to the right of *Target Grid* and select *Create new grid in existing project* (allows you to import this grid into an existing grid system and gives it the same cellsize and extent as that system).

Click *Okay*

A new window called *Choose Grid System* appears click in the box to the right of *Grid system* this time we want to choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10).

Click *Okay*

A new window called *Down-Scaling* appears click in the box to the right of *Interpolation Method* and choose *Bicubic Spline Interpolation*. This method is well suited to interpolating continuous data.

When the process is completed click on the *Data* tab at the bottom of the *Workspace* to check the new data looks right. Under Grids you want to look at the data under the second 10m

resolution grid system, it will have your dtm and the land cover data under it. View the data by double clicking on it, choose the top existing Map and click **OK**.

Step L. As per K, but for the landcover – and the same trick – we have to get the landcover (30 m) data onto the same resolution as the topography (10 m in this application) – note that you should think about what CORINE actually is – it is derived from satellite imagery (i.e. it is synoptic) – try sitting in a field one day, write down the land use, and see for how long it stays the same – this may take a few years – i.e. a critical question about SCIMAP is the validity of the assumptions we make about land cover

In the **Modules** tab click **Grid – Tools** then double click on **Resampling**

Click in the box to the right of **Grid system** choose the grid system for the CORINE data this will be the one that starts with a 100 because the CORINE data is at 100m resolution.

Click in the box to the right of **>> Grid** choose the corine data (it should be the only option)

e.g. **corine_100m**

Under **Options**

Click in the box to the right of **Target Grid** and select **Create new grid in existing project** (allows you to import this grid into an existing grid system and gives it the same cellsize and extent as that system).

Click **Okay**

A new window called **Choose Grid System** appears click in the box to the right of **Grid system** this time we want to choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10).

Click **Okay**

A new window called **Down-Scaling** appears click in the box to the right of **Interpolation Method** and choose **Nearest Neighbor**. This method should be used when interpolating classified data since it ensures that only existing classes are maintained.

When the process is completed (i.e. blue progress bar disappears and you hear a beep). Click on the **Data** tab at the bottom of the **Workspace** to check the new data looks right. Under Grids you want to look at the data under the second 10m resolution grid system, it will have your dtm and the land cover data under it. View the data by double clicking on it, choose the top existing Map and click **OK**.

Save Grids Project. We are now ready to start SCIMAP so we should save our data again.

On the top toolbar click **File** then choose **Project** then **save project as**

Check that you are in your workspace and if you aren't then navigate to it as before.

In the File Name box type the name of your catchment and something to indicate this is the pre-processed data.

e.g. [catchmentname]_pre.sprj

Click **Save**

In the pop-up window check the box beside **Save all**

Click **Okay**

Session 2: Running SCIMAP, Exporting and interpreting its predictions

Overview

- We will produce risk predictions using SCIMAP
- These maps are most easily interpreted in ArcMap. To do this we need to export the data from SAGA, read it into ArcMap and visualise it using a consistent method.
- We will then be ready to start examining and interpreting the results

Aims of Session 3

1. To export the generated risk maps from SAGA
2. To load these maps into Arc Map
3. To examine the SCIMAP predictions

Step A. We are now going to calculate the erodibility of a location given its land cover

Some discussion ... and space for notes

A1. In the Modules tab click **Grid – Tools** then double click on **Change Grid Values**

Click in the box to the right of **Grid system** choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10).

Click in the box to the right of **>> Grid** choose your landcover raster

e.g. [catchmentname]_lcm_10

Click in the box to the right of *< Changed Grid* and select [\[create\]](#) (this will create a new grid as an output)

Click in the box to the right of *Lookup Table* then click on the *...* icon, click on *load*, navigate to the saga2.0 folder in your workspace select [reclass_Corine_to_fs_risk2.txt](#)

Click *Open*

Click *Okay*

Step B. We can now run SCIMAP

Some discussion ... and space for notes

D1. In the *Modules* tab click *SCIMAP Risk Maps (beta 20 July 07)* then double click on *Fine Sediment Risk*

Click in the box to the right of *Grid system* choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10) again.

Click in the box to the right of *>> Dem:* choose your topography raster

e.g. [\[catchmentname\]_dtm_10](#)

Click in the box to the right of *>> Erodability* choose your new rescaled landcover raster

e.g. [Changed Grid](#)

Click in the box to the right of *>> Rainfall Pattern* choose your rainfall raster

e.g. [\[catchmentname\]_rain_10](#)

Check the boxes for *Fill DEM?* And *Use stream power?*

Click *Okay*

This shouldn't happen for the segment of the Eden we are using at 10m resolution, but if SAGA crashes at this point it is probably because your datasets are too large – either covering too large an area or a smaller area but at too high a resolution. You need to go back into ArcMap, resample each of the grids at a coarser resolution then reconvert them to ASCII. Once you have done this repeat the steps in SAGA. Or you could try doing the calculation for a smaller area, but at the higher resolution, by moving your pour point (Session 1, Step E) upstream.

Once SAGA has successfully run SCIMAP go to the *data* tab to check the outputs are all there. You should have the following rasters:

Slope, Catchment Area, Channels, Erosion Risk, Surface Flow Index, Accumulated Erosion Risk, Erosion Risk in Channels, Erosion Risk in Channels concn.

Some discussion ... and space for notes

Step C. We now need to save the grids again

C1. On the top toolbar click *File* then choose *Project* then *save project as*

Check that you are in your workspace and if you aren't then navigate to it as usual.

In the File Name box type the name of your catchment and an indication that this is for the completed model

e.g. [catchmentname]_fs.sprj

Click *Save*

In the pop-up window check the box beside *Save all*

Click *Okay*

Step D. We have our data as a raster dataset – they are much better to use as vectorised files

E1. In the *Modules* tab click *Shapes – Grid* then double click on *Grid values to points*

Click in the box to the right of *Grid system* choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10) again.

Click in the box to the right of *>> Grids* then click on the *...* icon, click on *Erosion Risk in Channels concn* then click on the *>>* icon then *Okay*

Click in the box to the right of *<< Points* choose [create]

Check the box for *Exclude NoData Cells*

Click *Okay*

Step E. We can now export the data for viewing

E1. To export points as a shapefile (a suitable format to import into ArcGIS). In the *Data* tab in the *workspace* box right click on the Points you want to save

e.g. *Points from Grid(s)*

E2. Choose *save shapes as*

Check that you are in your workspace and if you aren't then navigate to it as usual.

In the File Name box type the name for the fine sediment risk points

e.g. *[catchname]_fs_riskc.shp*

E3. In the *Modules* tab click *Import/Export – Grids* then double click on *Export ESRI Arc/Info Grid*

Click in the box to the right of *Grid system* choose the grid system for the **New Catchment** (i.e. the second one that starts with a 10) again.

Click in the box to the right of *>> Grid* choose the raster that you want to export (start with *Erosion Risk* but you can export as many of the rasters as you like).

Click in the box to the right of *File* then click on the *...* icon, navigate to your workspace, in the *File Name* box type your name for the erosion risk (note that SAGA will give it a .asc extension).

e.g. *[catchmentname]_erisk.asc*

Step C. We view the raster data in ARC

C1. Open ArcMap

C1. Click on *ArcToolbox*

C2. Choose *Conversion Tools* then *To Raster* then *ASCII to Raster*

In the *Input ASCII raster file* box navigate to your workspace and select the erosion risk ascii file (note you may need to change the *Files of type* to (*.ASC) in order to see your files)

e.g. *[catchmentname]_erisk.asc*

In the *Output raster* box type a file name for the converted raster

e.g. *[catchmentname]_erisk*

Change the *Output data type* to 'FLOAT'


Click *OK*

C3. The new dataset will be displayed once the process is complete. To change the colour bar left click on it in the Layers window and you will see a drop down list of other alternatives. There is also a check box here to invert the colour bar, i.e. ensure green is low and red high risk.

Step D. We view the vector data in ARC

D1. Click *File* then select *Add Data* navigate to your workspace add the risk concentration shapefile that you saved in SAGA

e.g. [catchname]_fs_riskc.shp

To do this you will have to re-connect to the folder that is your workspace using the  icon as you did in step A3 of the first session.

D2. In the *Layers* box on the left hand side of the ArcMap screen right click on the newly imported shapefile and choose Properties.

D3. Select *Quantities* from the *Symbology* tab

D4. Change the *Value* field to 'EROSION RISK' and *OK* the warning about sample size.

D5. Click *Classify* and again *OK* any warning, click the *Sampling* button and add "00000" to the end of the *Maximum Sample Size* value shown then click *OK*


D6. Change the classification *Method* to 'Standard Deviation' and the *Interval Size* to '1/3 Std Dev' *OK*

D7. Click on *Symbol* underneath the Color Ramp box choose *Properties for all symbols* then *Properties* then uncheck the *Use Outline* box click *OK* then change the *size* to 2.00, click *OK*

D8. Click on the dropdown arrow for *Color Ramp* and select the green – red colour ramp (this will already be selected but needs doing again after changing symbol properties). Click *OK*

Step E We will find this data easier to interpret with some additional information about the catchment so that we can orientate ourselves. The Ordnance Survey have good GIS data for this that we can use for today.

E1. Click *File* then select *Add Data* navigate to X:\data\strategi then choose either strategi-north or strategi-south depending on where in the UK your catchment is, add the relevant features that you think might help you to identify locations in your catchment (you will need to do this by single clicking on the feature then clicking *Add*

NOTE, you will again have to connect to the folder that contains the data X:\data using the  icon as you did in step A3 of the first session.

E2. You may find: 'coast', 'rivers' and 'river2' useful. You may also want to add some local towns of villages and display their names. You can do this by adding 'village', 'town' or 'city'.

E3. To display town or village names

E3a. In the *Layers* box on the left hand side of the ArcMap screen right click on the newly imported shapefile and choose Properties.

E3b. In the *Labels* tab check the box *Label features in this layer* in the *Label Field* box choose *FM* from the drop down list.

E4. You can navigate around the map using the icons on the Tools Toolbar to zoom and scroll as you did in step E5 of the first session.