

Create a New Project for Practical #2

Arc GIS ° Pro	ArcGIS Pro	5	? − □ × Adrian University of Portsmouth
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- Save your project to:
 - Documents\ArcGIS\Projects
- My save location is different as I save projects to the D:\ drive on my laptop
- You can save your projects on a USB stick etc. if you prefer; just remember where you've saved them!!!!

Set up your environment



- ArcGIS Pro saves settings of which tools you had open in previous sessions. For ease set it up as right:
 - Map ribbon is selected
 - Catalog is shown in RHS pane
 - Contents (Drawing Order) shown in LHS pane
- If these settings get perturbed for some reason (e.g., it's quite easy to 'float' a pane and then have difficulty 'docking' it again) click the View ribbon and hit Reset Panes to get things back to normal

Expand Databases in the Catalog



- Click the little arrow next to Databases in the Catalog pane (RHS) of ArcGIS Pro:
 - You will see the **GIS_WK_02** Geodatabase created automatically when we created this project a few moments ago
- ArcGIS <u>Geodatabases</u> enable you to save multiple map layers in one **.gdb** file (which is actually a directory consisting of many files, see later...)

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Examine the Geodatabase file from Practical #1

- Use Windows File Explorer to navigate to the location you saved last week's project, e.g.:
 - Documents\ArcGIS\Projects\GIS_WK_01
- Within that directory you should see GIS_WK_01.gdb
- Double click to open it...

Lots of files

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- ArcGIS Pro manages the files in the Geodatabase directory and <u>you should not edit or rename any</u> <u>files yourself</u>; things would go wrong!
- However, the key thing to note is that Geodatabases are reusable...

Back in ArcGIS Pro...



- Right click on Databases in the Catalog pane and hit...
- Add Database...

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Find last week's Geodatabase

- Navigate to the location where you stored last week's project
- This should probably be, e.g.:
 - Documents\ArcGIS\Projects\GIS_WK_01
- Select GIS_WK_01.gdb and open it...

Expand the GIS_WK_01 Geodatabase



- In the Catalog pane expand the GIS_WK_01 Geodatabase by clicking the little arrows...
- Your ArcGIS Pro screen should appear as right...
- Your map layers from last week are still there!
- Phew... No need to waste time recreating them...



Add the two map layers from last week

- Left click to select the first map layer and hold down the Shift key while selecting the second; they
 should both be selected...
- Right click and hit Add to Current Map (then wait patiently) to add the two layers to your map...





Raster maps are loaded and footprints are displayed...

- Your two raster data sets from last week are now in the map view...
- NOTE: the footprints (green boxes) for both the OS OpenMap Local (larger) and the GetMapping aerial photography (smaller) raster layers

Zoom in...



Right click on the GetMapping layer and click Zoom to layer...

Alter layers...



- In the Drawing Order pane (LHS) you can see the GetMapping layer is beneath the OS OpenMap Local layer
- Hence you cannot see it...
- Left click the GetMapping layer and, while holding the mouse button down, drag it up over the OS OpenMap Local layer

Layering altered...



• The smaller footprints of the GetMapping raster tile outlines are shown, but not the aerial photography data itself...

Search for PA20 9LL



This is the postcode for Ascog Farm on the Isle of Bute...

Use Locate to find it...

Here we are back at the farm again...

Save your project!



- Just like MS Office applications it's a good idea to save your project every so often...
- If you don't and the software or computer crashes you would lose your work...
- Hit Save button top LHS...

What have we learnt so far?

- You can have multiple projects...
- By default, each time you create a new project from the home screen a new Geodatabase will be created within the project directory...
- Within the Geodatabase ArcGIS Pro organises multiple raster and vector map layers you have added and creates <u>spatial indexes</u> etc...
- A project can reference multiple Geodatabases and individual map files:
 - As you progress, organise your Project and Geodatabase files so you know where they are...
 - If files or Geodatabases move or get deleted you will have to redo all the steps that led to their creation!

Now let's digitise...

- So far we have used ArcGIS Pro to draw maps either using standard base maps or the two basemaps (OS OpenMap Local and GetMapping Aerial Photography) that we have set up ourselves...
- We now want to 'digitise' several features in and around Ascog Farm:
 - o The pole locations and line of the 11kV electrical transmission that crosses the fields
 - The outline of the farm itself
 - Houses that are near to the farm
- All of these geographical entities were relevant to the planning application for wind turbines!

Old school?



This sort of work used to be achieved by digitizing using <u>an electronic tablet</u> tracing over a map...

The department used to have several large digitizing tablets and ArcGIS Pro still supports this functionality...

However, we will use a mixture of data entry and 'heads-up' digitization which has largely replaced this 'old school' way of digitizing maps...

You've received an email...

It reads:

- We've driven over the ground following the line of the pylons at Ascog Farm.
- A scan of the coords is attached. Note the coords are in degrees and digital minutes not traditional degrees, minutes, seconds as I understand it <u>so you might need to make some</u> <u>conversions</u> to get things appearing in the right place.

You've received another email...

A8 55°49.436 -5°02.209 A9 Alo 55 49.509 -5 02.235 All 55 49.554/-5 02.246 Alz 55 49.619 -5 02.265 A13 55 49.661 -5 02.275

- The farmer has been out again, scrambling through the bracken, to get the location of a few more poles...
- A9 was too inaccessible so there are no coordinates for it...

We can use these coordinates to map the electricity pole locations!



ArcGIS Pro likes to work in <u>Decimal Degrees (DD)</u> for Latitude and Longitude coordinates, e.g.:

55.82193, -5.02905

As mentioned in the email, the coordinates captured by the Garmin GPS are in Degrees Decimal Minutes (DDM), e.g.:

55 49.316, -5 1.743

There are various converters to move from one Lat/Lon coordinate layout to another...

This can also be achieved using Excel...

PoleNo	DegreesLat	DecimalMinutesLat	DecimalLat	DegreesLon	Decimal Minutes Lon	DecimalLon
A1	55	49.316		-5	1.743	
A2	55	49.319		-5	1.826	
A3	55	49.372		-5	1.845	
A4	55	49.379		-5	1.962	
A5	55	49.385		-5	2.058	
A6	55	49.388		-5	2.133	
A7	55	49.392		-5	2.199	
A8	55	49.436		-5	2.209	
A10	55	49.509		-5	2.235	
A11	55	49.554		-5	2.246	
A12	55	49.619		-5	2.265	
A13	55	49.661		-5	2.275	

Capture coordinate data in Excel...

- Create a new blank Excel spreadsheet
- Add column headings as above and **copy the coordinate data** above that was contained in these two emails into Excel...
- NOTE: that the DecimalMinutesLat and DecimalMinutesLon are in their own columns
- NOTE: ignore Pole A9 for which we have no coordinates!
- NOTE: be sure to include minus signs for the DegreesLon values if you key the data in yourself!

To calculate decimal Lat & Lon...

To move from DDM 55 49.316, -5 1.743 (as recorded) to DD 55.82193, -5.02905 (as required) we can use this equation:

Degrees Minutes.m to Decimal Degrees

.d = M.m / 60

Decimal Degrees = Degrees + .d

So:

55 + (49.316/60) = 55.82193

-5 + -(1.743/60) = -5.02905

Notice that we have Longitude -5 added to -(1.743/60) as Ascog is West of the Prime Meridian

Instructions

In the first (blank) row of your DecimalLat column (Cell D2) type the following and hit enter:

=B2+(C2/60)

In the first (blank) row of your DecimalLon column (Cell G2) type the following and hit enter:

=E2+-(F2/60)

Don't forget the minus sign ahead of the opening bracket in this second equation!

You should see values of 55.8219333 for DecimalLat and -5.02905 for DecimalLon

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Copy formula down columns

- Select the DecimalLat cell you've just populated by clicking on it and notice at bottom RHS of the green highlighting a little dot...
- When you hover your mouse over the dot a crosshair appears; double click the crosshair; this will copy the formula down all the rows in the column...

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Repeat for the DecimalLon column

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- Use the correct formula for the DecimalLon column:
 - =E2+-(F2/60)
- You should now have a spreadsheet looking like this
- Hit File -> Save As...

Save the spreadsheet as a CSV file

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- ArcGIS Pro should be able to read Excel and other files but the correct drivers might not be installed on the Lab machines...
- For ease of use just save the spreadsheet as a CSV file; choose a sensible file name and folder to save it in (e.g., your Documents folder)...

Back in ArcGIS Pro...



- In the Map ribbon click the little arrow on the Add Data button...
- Select the XY Point Data option to 'Add x,y point data to the map'...

Configure import...

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- Click the browse folder icon next to Input Table and navigate to your Documents folder or wherever you stored the CSV file with coordinates...
- You should see a display as right...
- Select your CSV file and hit OK...



Continue configuring import...

- Having hit OK you will be presented with a screen as right...
- Some of this needs to be changed:
 - Change X Field to DecimalLon
 - Change Y Field to DecimalLat
 - Leave coordinate system as is (GCS_WGS_1984)
- Things should look as above...

Import!



- Hit the Run button...
- A status bar will appear lower RHS in the Geoprocessing pane

Import done!



Once the import is finished you should see:

- A notification bottom RHS ('XY Table to Point completed')
- Your new map layer has appeared in the Contents pane to LHS
- Point locations (small red dots; yours may be a different colour) showing the location of the electricity poles!!!!

Zoom to layer...



Right click your new Pole Locations layer and hit Zoom To Layer...

All being well, it should appear as above...



Layer added to Geodatabase!

• If you look in the Catalog pane to RHS and expand the **GIS_WK_02** Geodatabase you will also see the new layer ('Feature Class' in ArcGIS Pro parlance) has been added to the Geodatabase...

Now let's create lines...



- The 11kV (kilovolt) electricity supply that crosses the Ascog fields on poles is best represented by lines...
- These lines can be created in ArcGIS Pro software by linking the X/Y Points that we have just created...





- In the Geoprocessing pane to RHS click on the Plus symbol at the top of the pane...
- Click Open Another Tool...





• Type 'points' (without the quotes) in the search box and the first tool (<u>Points To Line</u>) is the one to select...



Set up Points To Line tool...

- Use the drop down next to Input Features to select the table of pole locations. Mine is called:
 - Ascog11kvPoleLocations_XYTableToPoint
- In the Output Feature Class name it something sensible, e.g.:
 - Ascog11kvLine
- Leave the Line Field and Sort Field blank...
- Hit the Run button...
- The lines are shown in red (you may get a different colour)...

Alter map display...



- To make things clearer on these slides I've altered symbology a bit:
 - Footprint of GetMapping layer turned off
 - Dots for Pole Locations layer made bigger and brighter (red)
 - Lines for Ascog11kvLine layer made thicker and brighter (yellow)
- If you do the same you should be able to see your electricity poles and lines more clearly!



Now's a good time to save the project...

• Hit the Save button top LHS...

Now let's digitise some more...

Our map is now starting to look pretty decent with electricity pole and line locations against a backdrop of GetMapping Aerial Photography data

We now need to digitise:

- The external boundary of the farm
- The nearest houses around this boundary

The farm boundary is shown on the following page, downloaded from the <u>Registers of Scotland</u> site:

 You can also open a high resolution JPG from Moodle (GIS Practical #2 – Ascog Farm Title Outline)

Let's get started...



Digitising the farm boundary...

The high resolution PDF from the Registers of Scotland showing the registered title of the farm can be downloaded from Moodle...



Digitising the farm boundary...

- Zooming out a bit (mouse wheel) you can see the land on the GetMapping Aerial Photography layer, as right...
- See how this compares to the Registers of Scotland map (previous page)...

Create a New Feature Class...



Right click on the GIS_WK_02 Geodatabase and click New -> Feature Class...

A Feature Class is ESRI/ArcGIS jargon for a map layer...

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Define the New Feature Class...

Name your new feature class, e.g., MyAscogFarmOutline...

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-.....

Leave the Feature Class Type set to 'Polygon'; we will be creating one polygon for the external boundary of the farm ...

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Uncheck the Z Values tick box, we're not going to be storing any height data... •

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Click Next... •

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- Click on 'Click here to add a new field'...
- Call the new field 'Name' (without the quotes) and leave it as Text Data Type...
- Click Next...

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- Leave the coordinate system as British National Grid...
- ArcGIS Pro has correctly 'guessed' this is the coordinate system we should use based on the other layers in the map...
- Click Next...

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- Leave the Tolerance settings in their default values...
- Click Next...



- Leave the Resolution settings in their default values...
- Click Next...

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- Leave the Storage Configuration settings in their default values...
- Click Finish...

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New Feature Class created!

- In the Catalog you will see your new layer in the **GIS_WK_02** Geodatabase...
- Right click on your new layer (e.g., MyAscogFarmOutline) and add it to the current map...
- Change symbology...

Change symbology...

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- The default setting (black edges, pink fill) will obscure the background map you are trying to digitise over...
- Right click your layer and hit Symbology...
- In the Symbol menu change it to No fill with a strong outline colour of your choice...

Change symbology...



- I've gone No Fill, Red Outline Colour 2pt width...
- Hit Apply in the RHS Symbology pane...

Edit and Create Features...



- Click the Edit ribbon at the top of ArcGIS Pro...
- Click the Create button...
- Expand your layer (e.g., MyAscogFarmOutline) and click on the Polygon feature...
- A toolbar appears at the bottom of the map...
- When you hover over the map your cursor has changed to a crosshair...

Get digitising...



- Consult the Registers of Scotland title map (it may help to print it out)...
- Zoom into a good starting point (e.g., the corner of a field) using the mouse wheel...
- Click, click, click to add vertices to the polygon...
- Press and hold the mouse wheel down to pan the map once you run out of map to digitize on...
- If you start going clockwise keep going in that direction! If you cross over your own polygon you will get unwanted effects...

Continue digitising...



- I started in the SW corner of the farm...
- I followed a field line then around the corner and up to the Loch...
- As you digitise you can zoom out and in again with the mouse wheel (or press and hold the mouse wheel and pan the map) to reposition the map so you can continue to digitise on top of it...
- When you get close to where you started double-click with the left mouse button to finish the polygon...

Digitising done!



- I didn't zoom in much and created a really crude outline of the farm, as right!
- I expect your efforts to be somewhat better!!!
- There are lots of options in the Edit/Create menu, see the <u>ArcGIS Pro Help</u> to understand what they all do...
- Click Save in the Edit ribbon to save your outline...

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Assess the quality of your Ascog Farm outline...

- In Windows File Explorer browse to:
 - EDINA Digimap\Ascog Farm\Miscellaneous
- This directory is off the standard geodata file location shown in Slide 3
- In this folder there is a ZIP archive named AscogTitleOutline.zip
- Copy this file to your computer and unzip it to your Documents folder...



Add TitleOutline boundary...

- In the Map ribbon click Add Data...
- Navigate to your Documents folder and the file named TitleOutline.dxf...
- Double click on this file...

Add TitleOutline Polygon boundary...



- Select the Polygon layer from within the .dxf file...
- DXF stands for Drawing eXchange Format and is an AutoCAD standard file format...
- Hit OK...



TitleOutline-Polygon added!

- The TitleOutline.dxf Polygon layer has been added to the map...
- It displays with dark see-through shading you can change using your Symbology skills...
- QUESTION: How does it compare to your digitised boundary?
- Change the symbology to alter colours if that helps...



TitleOutline-Polygon symbology changed!

- I have coloured the TitleOutline.dxf Polygon layer with No Fill and a Blue 2pt outline...
- Oh dear! My crudely digitised boundary (red) is nothing like the real thing (blue)!!!!!!
- QUESTION: Is yours any better?

Why it the TitleOutline-Polygon boundary so good?

- Instead of digitising the outline over aerial photography or OS base maps I downloaded OS MasterMap from <u>EDINA Digimap</u>...
- I then selected the various sections of vector data road segment, field boundary, Loch edge etc. that make up the true boundary of the farm; comparing my selections to the Registers of Scotland title map...
- I then converted all of these selected polylines to one closed polygon...
- This is outside the scope of this practical but you can try it yourself if you want!



Save TitleOutline-Polygon to your Geodatabase...

- Having displayed the TitleOutline.dxf Polygon layer you can now save it to your GIS_WK_02 Geodatabase...
- Right click on the layer and hit Data -> Export Features...



TitleOutline-Polygon saved to your Geodatabase!

- The Catalog will now show layer **AscogFarmTitleOutline** (if that's what you called it) which has also been added to the map...
- You can now remove **TitleOutline-Polygon** (imported from the .dxf file) by right clicking on it and hitting Remove...

Save your project!

- That's a good bit of editing done...
- Save your project...

Now let's digitise some more...

- Our map is now starting to look pretty decent with electricity pole and line locations against a backdrop of GetMapping Aerial Photography data and the farm boundary shown!
- We now need to digitise:
 - The nearest houses around this boundary
- You should now have the capability to do this...

Quick cheat sheet...

- To digitise neighbouring houses:
 - Create a new feature class in your **GIS_WK_02** Geodatabase as Points (Page 42 onwards, change Polygons to Points as you define the new feature class)...
 - Digitise the locations of houses visible on a base map of your choice...
- Remember to Save your edits when you are done!

Digitise neighbouring houses...



- Once you're editing your new NeighbouringHouses layer you should see something like this...
- I switched GetMapping aerial photography layer off to digitise over the OS OpenMap Local base map as it's easier to spot the houses...

Save neighbouring houses!



- Zoomed out I arrived at something like this...
- Hit Save in the Edit ribbon to save your changes...
- Hit Save top LHS to save your project...
- We will use the data we have created today next week!!!!