



Annex 2: B-Lines Step by Step methodology for ArcGIS model and Linkage Mapper

Stage 1 - Data collation – no modelling work

Stage 2 - Identification of Potential B-Lines Core Habitat Areas

Key habitats are extracted from PHI_ProjArea using an extract by attributes query in ArcGIS where Main_PHT contained one or more of the key habitat types (An example given in Table 1). The resulting layer is named KeyMain.

Key habitats are extracted from PHI_ProjArea using an extract by attributes query in ArcGIS where Addn_PHT contained one or more of the key habitat types (Table 1). The resulting layer is named KeyAdd. These two layers are then combined into a single layer of key habitat types called KeyMainAddUnion using 'union' in ArcToolBox.

Boundaries between adjacent key habitats in the layer KeyMainAddUnion are then dissolved using 'dissolve' in ArcToolBox creating the layer KeyMainAddUnion_Dissolve1. A column is added to the attribute table for this layer and the areas in Ha for each polygon calculated using 'calculate geometry'. An attribute query is then used to select polygons with an area greater than 2Ha and these selected polygons are exported to a new layer called KeyMainAddUniDis2HA.

This entire process is then repeated for the beneficial habitat with all layers produced following the same naming convention but using the term Ben in place of Key.

Mapping selected Key Habitat	Mapping selected Beneficial habitat
Maritime Cliff and Slope (MCSLP)	
	Salt marsh (SALTM)
Lowland Calcareous Grassland (LCGRA)	Reedbeds (RBEDS)
Lowland Fens(LFENS)	
Coastal Vegetated Shingle (CVSHI)	
Lowland heathland (LHEAT)	
Lowland dry acid grassland(LDAGR)	
Lowland meadows (LMEAD)	Deciduous Woodland(DWOOD)
Purple moor grass and rough pasture (PMGRP)	
Traditional orchards (TORCH)	
Coastal Sand Dunes (CSDUN)	
Good Quality Semi-Improved Grassland (GQSIG)	
Coastal & Flood Plain Grazing Marsh (CFPGM)	

Table 1: Mapping selected Key and beneficial habitats

The next step in the flow diagram involves the identification of areas of SSSI Quality vs Non SSSI Quality. KeyMainAddUniDis2HA is overlaid with the provided SSSI shapefile. A new layer consisting of areas of key habitat within SSSIs is created using the 'intersect' tool in ArcToolBox and the new layer named KeyMainAddUniDis2HASSSI. A second new layer consisting of areas of key habitat not within SSSIs is created from the KeyMainAddUniDis2HA and SSSI layers using the 'erase' tool in ArcToolBox and the new layer named KeyMainAddUniDis2HAnonSSSI. Similarly BenMainAddUniDis2HA is overlaid with the provided SSSI shapefile. A new layer

consisting of areas of beneficial habitat within SSSIs is created using the 'intersect' tool in ArcToolBox and the new layer named BenMainAddUniDis2HASSSI.

The next step in the flow diagram requires a buffer to be added to each of the habitat core areas created above. Key habitats within SSSIs (KeyMainAddUniDis2HASSSI) are buffered with a 500m buffer using 'buffer' in ArcToolBox. Both key habitat areas not in SSSIs (KeyMainAddUniDis2HANonSSSI) and beneficial habitat areas inside SSSIs (BenMainAddUniDis2HASSSI) are buffered with a 250m buffer using the 'buffer' tool in ArcToolBox. All buffers are created with the dissolve type set as 'all'. These 3 buffer layers are then merged using 'union' in ArcToolBox to create the B-Lines Habitat Areas.

Stage 3 - Producing the B-Lines Network

The use of linkage mapper requires creating a resistance surface map for the project area. The Land Cover Map 2007 is used to provide the cost weighting for the production of the resistance map. Table 2 provides an example of the land covers and scores allocated to them where high scores equal high resistance.

Land Cover Type	Score
Acid grassland	1
Arable and horticulture	6
Broad leaved, mixed and yew woodland	4
Built up areas and gardens	5
Coniferous woodland	8
Dwarf shrub heath	1
Fen marsh and swamp	10
Freshwater	10
Improved grassland	5
Inland rock	10
Littoral rock	8
Littoral sediment	10
Neutral grassland	1
Rough low-productivity grassland	2
Salt water	10
Supra-littoral rock	8
Supra-littoral sediment	10

Table 2: Scores attributed to land cover types.

To allocate the scores to the land cover map the attribute table for the land cover layer clipped to the project area (LCMVectorclip) is exported and opened in excel (LCM.xls). The BH column is duplicated and then a simple find/replace used to create a column of scores. In ArcGIS a new column is created in the LCMVectorclip attribute table and labelled 'cost'. An editing session for this layer is then opened allowing the score column from excel to be pasted into this new column in the attribute table in ArcGIS. The edit session is then saved and closed. A resistance raster is then created using the 'convert to raster' tool in ArcGIS (reslayer2).

Linkage mapper uses a GIS shapefile of B-Lines Habitat Areas and the produced resistance surface raster in its operation. However, the tool does not seem capable of tolerating null-data areas in the raster where these areas coincide with B-Lines Habitat Areas. In many cases the B-Lines Habitat Areas may extend into the sea or estuary areas where there were no data in the resistance raster. Thus before linkage mapper can be run these areas have to be clipped from the B-Lines Habitat Areas layer using the resistance raster as a mask. The resistance raster

reslayer2 is converted to a polygon using 'convert from raster' in ArcToolBox and unchecking the simplify polygons box. This polygon layer reslayer2 is then used to clip the B-Lines Habitat Areas creating a new layer BLinesHabAreasClip2. In the attribute table of BLinesHabAreasClip2 a column is added (polygon) to contain a unique ID field for each polygon as required by Linkage Mapper. Each polygon is numbered consecutively starting from 1. The BLinesHabAreasClip2 layer is then manually cleaned of gaps and adjacent polygons merged though opening an editing session to create BLinesHabAreasClip2cleangaps. However, some of the real gaps may be inadvertently removed and so this layer is clipped with BLinesHabAreasClip2 to produce a final layer for use in Linkage Mapper BLinesHabAreasClip2cleangapsClip.

Linkage Mapper is then run with the following inputs

Project Directory: TestBee3

Core Area Feature Class: BLinesHabAreasClip2cleangapsClip

Core Area Field Name: Polygon

Resistance Raster: reslayer2

For step 4 option A is set as 1 to connect each core area to its nearest in cost-weighted distance units, and option C is checked.

We did not undertake step 5.

The Linkage Mapper output line file TestBee3_lcpLines_s4 is added to ArcGIS. Main pathways are selected from the layer using a 'select by attribute' query for lines where 'Active' = 1. Selected lines are then exported to a new layer TestBee3_lcpLines_s4_MainOnly. These lines are then buffered with a 3km buffer (1.5km each side) using 'buffer' in ArcToolBox to create TestBee3_lcpLines_s4_MainOnlyBuffer. This layer is then clipped with the reslayer2.shp layer to remove areas of sea and estuaries to create a final buffered B-Lines layer TestBee3_lcpLines_s4_MainOnlyBufferClip.

In order to display the final map core habitat areas that are less than 2 ha (fragmented habitat) and thus removed from the modelling process, are required to be displayed as point data. Therefore an attribute query is used to select polygons from KeyMainAddUnion_Dissolve1 with an area less than 2 ha and these selected polygons are exported to a new layer called KeyMainAddUnionDisLessThan2Ha. This new polygon layer is converted to a point layer using the 'polygon to point' in the ETGeoWizard extension to ArcGIS (KeyMainAddUnionDisLessThan2HaPt).

Similarly an attribute query is used to select polygons from BenMainAddUnion_Dissolve1 with an area less than 2 ha and these selected polygons are exported to a new layer called BenMainAddUniDisLessThan2Ha. For beneficial habitats only those areas with SSSIs are of interest and so a new layer consisting of areas of beneficial habitat of less than 2 ha within SSSIs is created using the 'intersect' tool in ArcToolBox and the new layer named BenMainAddUniDisLessThan2HaSSSI. This new polygon layer was converted to a point layer using the 'polygon to point' in the ETGeoWizard extension to ArcGIS (BenMainAddUniDisLessThan2HaSSSIpt).