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Introduction to the B-Lines concept

The decline in insect pollinators is a matter of serious concern; our native wild pollinators are a key part of Britain's wildlife resource and are responsible for a high proportion of crop and wildflower pollination. Buglife's B-Lines project is working to identify linear pathways across the UK, along which a series of wildflower-rich habitat stepping stones will be restored and created. These enhanced linear pathways will help pollinator movement across the landscape, aiming to improve habitat connectivity and contribute to more resilient pollinator populations.

B-Lines are 3km wide 'dispersal corridors' which encompass and link the best and most extensive areas of existing wildflower-rich habitat. These are mapped based on key habitat assets from both national and local habitat datasets, and where possible by taking advantage of existing ecological network and biodiversity opportunity maps to help locate key linkages.

Developing the B-Lines concept

The Coast to Coast project identified such a network of B-Lines in the Cumbria, Lancashire and Greater Manchester area. Initially a wide range of habitat data was collected to identify wildflower-rich grasslands which are valuable for pollinators, such as lowland/upland meadows, lowland heathlands, lowland fen and parkland, along with mapped data for Sites of Special Scientific Interest (SSSIs), non-statutory designated area such as Local Wildlife Sites and other areas such as road verges. Using the ArcGIS 'Model Builder', key habitat areas (such as the most valuable wildflower areas and SSSIs) were mapped to create the core areas for the B-Lines to enhance. These sites were then buffered and merged to create a B-Lines Habitat Area map.

To help identify key linkages between the most important wildflower areas, the open source 'Linkage Mapper' tool was used, alongside a 'resistance map' created from the Centre for Ecology and Hydrology (CEH) Landcover map (with land uses given a resistance score based on their 'permeability' to pollinator dispersal and the ease of developing pollinator-friendly habitats). The Linkage Mapper used the B-Lines Habitat Area map and the resistance surface raster to allocate the least-cost linear pathways between these areas. The potential routes were then buffered to create 3km wide pathways and draft B-Lines maps produced.

A workshop was held with a diverse group of stakeholders and partners to discuss the proposed network which was then published on Google Earth to aid analysis and refinement. This helped to eliminate routes which might be difficult to achieve and highlighted particular areas of opportunity. Informed manual adjustments were made to the pathways, helping to create the final B-Lines network map.

B-Lines and the Condatis software

For the current case study, we used a trial version no. 0.3.78 of the software Condatis. To allow the B-Lines data to be used with the Condatis software, it was first essential that the merged habitat layer was rasterised into a single habitat layer, representing all of the best and most extensive currently wildflower-rich areas. A resolution of 1km was used with information contained in metres squared of habitat known to be of high value for pollinators, irrespective of type.

Comparing current or pollinator movements with the proposed B-Lines

The first use of the Condatis software was to assess the current flow of the B-Lines Habitat Area map, showing the movement of species through the landscape. A short dispersal distance of only 1km was selected as is appropriate for many insect pollinators. It was then possible to assess the overlap of the resulting calculated flow of species through the landscape with the proposed B-Lines routes. For this analysis we used an automatically generated source and target at the northern and southern borders of the landscape.

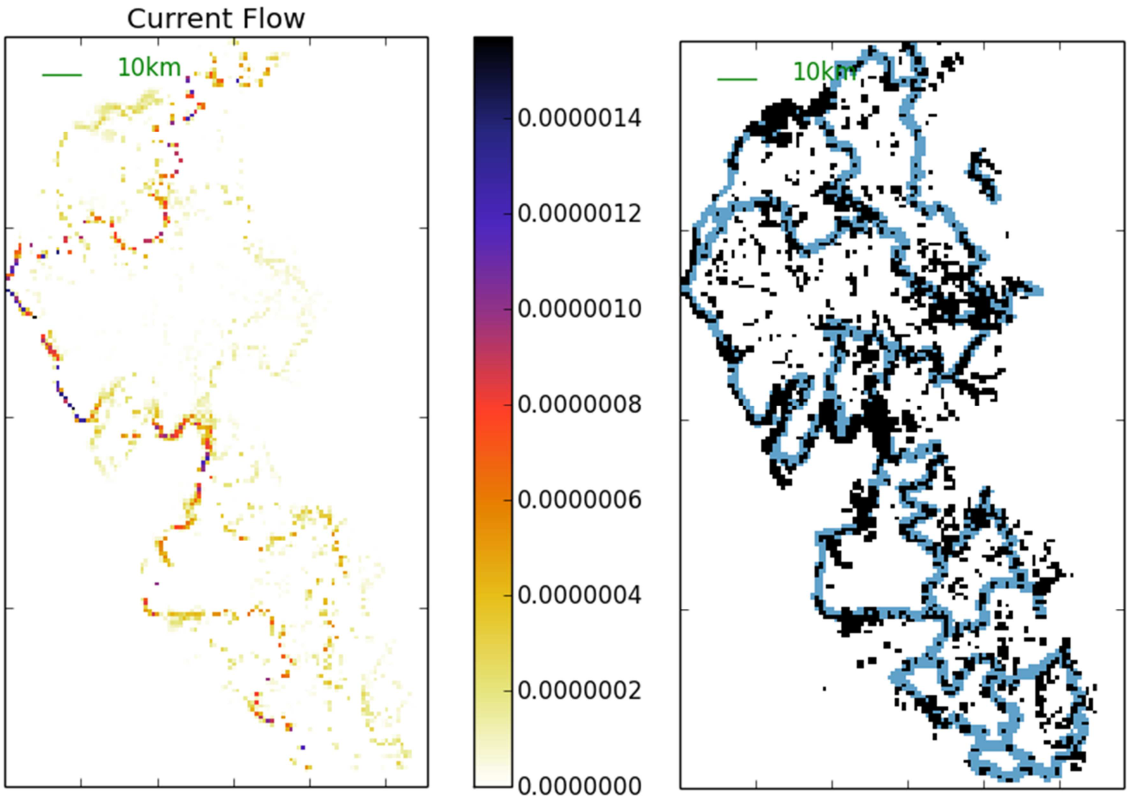

Fig 1: Left: current flow as predicted using the Condatis software to assess the B-Lines Habitat Area map. Right: The B-Lines habitat area base map (black) overlain with the proposed B-Lines network map (blue).

Although only a low current flow was identified using the software, there were clear similarities apparent between the resultant flow map and the B-Lines network map (Fig. 1). The highest current flows matched the west coast of the project area, however, some inland routes in the north and the south demonstrated higher flow than the surrounding landscape, and bore close similarity to the mapped B-Lines sections of the routes. This supports the chosen B-Line routes by identifying them as the areas with the greatest potential for movement, so therefore ideal for targeted enhancements to improve wider landscape connectivity.

Identifying key sites to enhance connectivity for insect pollinators

A valuable tool within the Condatis software is the backwards optimisation routine, which allowed Buglife to look at connectivity within the mapped B-Lines. By focussing on the B-Lines and the existing habitats within them we were able to calculate the contribution that each 1km cell adds to the overall connectivity of the network habitat when key habitats are created within them (Fig. 2). Effectively this prioritises the individual 1km cells which would best enhance the connectivity of the B-Lines should key wildflower-rich habitats be created. The sliding scale provided within the 'dropping view' of the software allows you to show how, for example, targeting a relatively small percentage of the B-Line for habitat creation can disproportionately enhance the connectivity of the landscape (Fig 2). Conversely it helps in identifying areas where adding habitat would contribute very little to the connectivity of the B-Lines, thus providing a useful cost-benefit tool to maximise the connectivity gains with a fixed area of habitat being created.

The software model allows the use of different sources and sinks. A number of different sources and sinks were trialled, to demonstrate how we could identify the most effective areas in which to target habitat creation along specific stretches of the B-Lines Habitat network (Fig. 3). By specifying sources and sinks, it was possible to focus on flow along individual stretches and by using the 'dropping view', identify the most effective cells for habitat creation. With different sources and sinks, this model can be run along the entire UK-wide B-Lines route, or particular focus areas to identify the areas where habitat creation would have the greatest contribution to connectivity. This is an incredibly useful tool to help prioritise area were proactive interventions may have the greatest potential benefits, thus helping the project to be as cost effective as possible

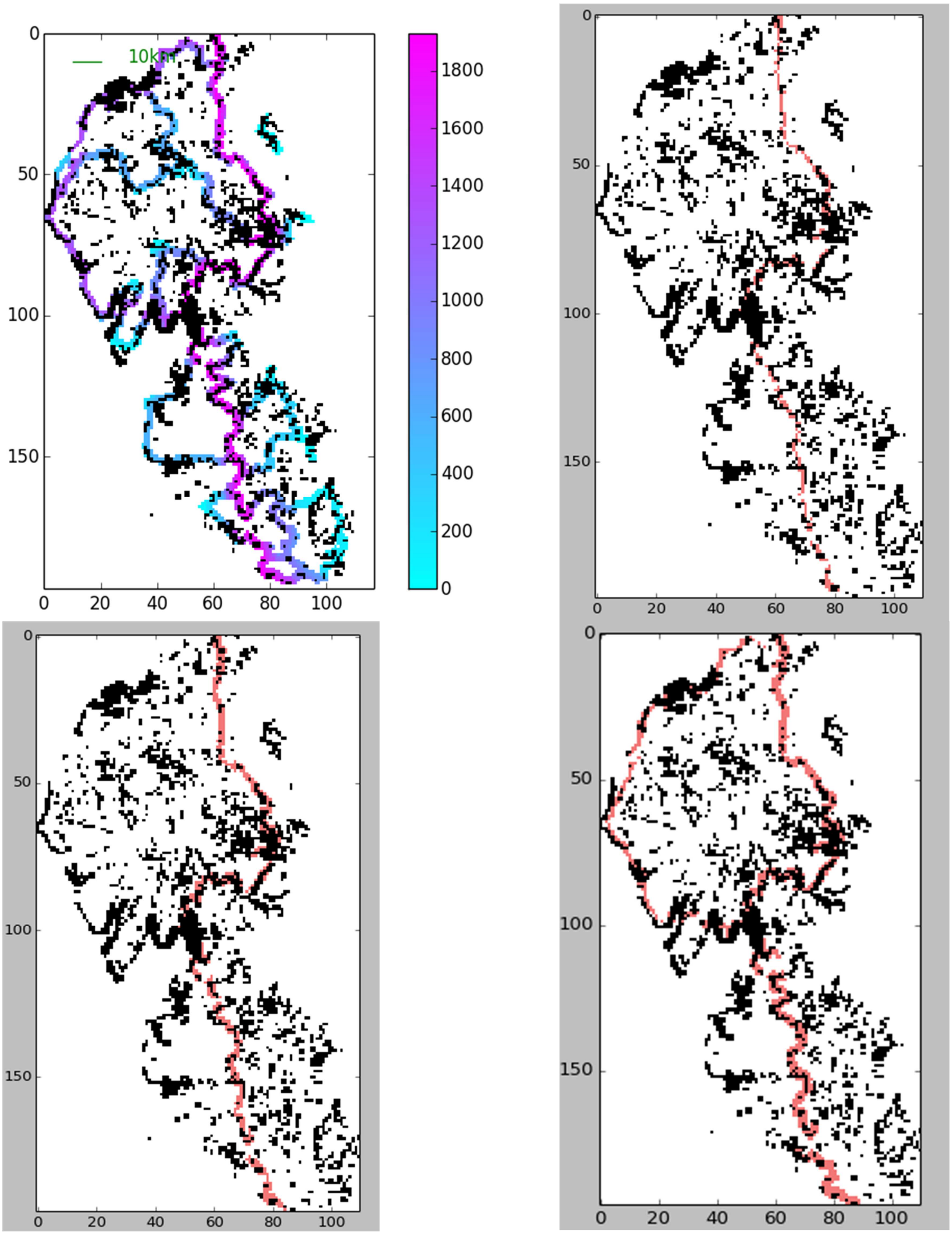

Fig 2: <u>Top left</u>: Backwards optimisation showing the relative contribution of cells to overall connectivity within the B-Lines, with present day habitat areas, where a north-south sink and source are used. The colour scale represents the ranked importance of each proposed B-line cell. By using the 'dropping tool' it is then possible to highlight how many of the 1,928 'empty' cells (i.e. those without key habitats) would be need to be converted to wildflower-rich habitats to provide a certain percentage flow. <u>Top right:</u> To achieve 10% of the overall north-south flow in the B-Lines, it is necessary to convert 190 cells. <u>Bottom left</u>: 351 cells converted can provide 25% of the overall flow. <u>Bottom right</u>: 50% of the overall B-Lines flow can be achieved using only 675 (35%) of the 1928 cells.

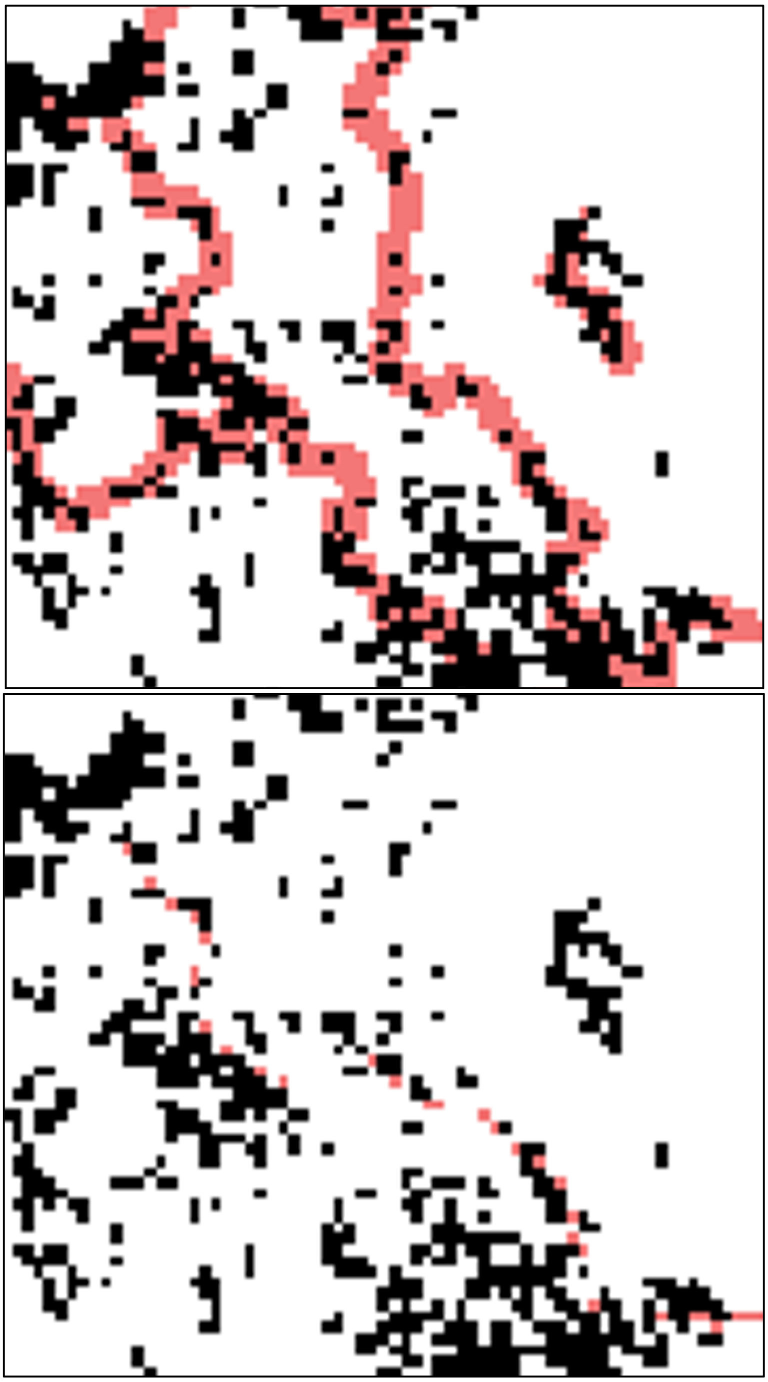

Fig 3: Focusing on small stretches by altering the source and sink can provide insight into the most effective areas to target habitat creation to increase connectivity. <u>Top</u>: Close-up view of part of the B-Lines network. <u>Bottom</u>: The same stretch of B-Line, with only the most effective cells for habitat creation shown in red, achieved by using the backwards optimisation tool. The cells highlighted in red should ideally be prioritised for habitat creation as they have a proportionally larger positive effect on connectivity than other cells within the B-Line.

Using Condatis to implement B-Lines

B-Lines aims to identify and then develop a UK-wide network of wildflower-rich habitats, to benefit insect pollinators as well as a range of other wildlife. As such B-Lines is identifying large-scale dispersal networks, linking together the best of existing areas, in a simple and pragmatic manner.

Once mapped we are looking to promote the need for B-Lines and to carry out significant habitat restoration and creation work. We will be both focussing on the enhancement of the condition of existing wildlife areas and developing larger clusters of habitat to protect existing species populations, but more widely we will be looking to develop the wider B-Lines pathways to help populations disperse more easily across large distances. We will aim to fill the B-Lines with more habitat to create corridors or chains of stepping stones. This is clearly a very ambitious and large-scale vision and in the shorter-term we will need to focus efforts on areas where we can achieve the greatest improvements in the ‘connectivity’ within the B-Lines for the least effort. We also need to highlight key areas for habitat improvements to key partners and other interested stakeholders. The Condatis model can help guide Buglife’s project development and action on the ground, while also providing guidance to local authorities, biodiversity partnerships (Local Nature Partnerships, Nature Improvement Areas, Biodiversity Action Plan groups) and other conservation agencies to help them identify areas of action.

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