Condatis Training Worksheet

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This worksheet is designed to guide you through performing an analysis in Condatis, in combination with the slides (available to download) and presentation during this training session. As with any modelling exercise, it is vital that you understand *why* you are performing the chosen analysis, exactly what input data is needed and what outputs you are expecting, so that you can identify whether the process has run properly and make the most effective use of the results in spatial conservation prioritization.

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# Introduction to training

Condatis 1.0 can be accessed [here](https://www.webapp.condatis.org.uk/). For more information on Condatis, its origin and the projects currently underway, please have a look at [our website](http://www.condatis.org.uk/).

**Goals of training**

To provide you with:

* A clear understanding of what analyses Condatis can perform and when it is appropriate to use it;
* The knowledge to run your own connectivity analysis through Condatis;
* The ability to produce graphical outputs from the results files; and,
* The ability to interpret the results of the analysis and consider how you might incorporate them into a report.

Resources required for training:

* A laptop/desktop computer with access to the internet;
* Input data for each Condatis case study, downloadable from the website; and,
* This *Condatis Training Worksheet* and the presentation slides that accompany the training session (also downloadable).

For further guidance on how to prepare the raster files for input into Condatis, please see the online [Help Documentation](http://www.webapp.condatis.org.uk/help/help.html).

# Reason for using Condatis

Below are some key questions to answer before you start your analysis in Condatis. There are no right or wrong answers, but a clear picture of what you want to achieve through using Condatis will help you to get the most out of the tool (further guidance is available in the online [Help Documentation](http://www.webapp.condatis.org.uk/help/help.html)). An example set of answers has been provided for the two case studies used in this training session: (i) the *Flow* demonstration analysis, which explores the movement of heathland species from the south to the north of England, and (ii) the *Dropping* demonstration analysis, which forms part of a conservation prioritisation planning exercise in Sabah, Malaysia, where a limited amount of resources have become available to increase the area of land under formal protection.

1. *Flow* analysis – England case study

|  |  |
| --- | --- |
| What kind of species are you interested in? | *A heathland specialist species, e.g. a winged insect or non-migratory bird species of mid- (5km) to long-range (10km) dispersal ability.* |
| Why do your species need to move between the focal source(s) and target(s)? | *As the climate of the UK warms, species will generally be pushed to move northwards to track appropriate temperatures. Specifically in England, we want to facilitate movement between the south coast and to or beyond the Scottish border.* |
| What constitutes habitat for those species within the landscape? | *Habitat classified as one of 3 priority habitat types - Lowland heathland, Upland heathland and ’Mountain heath and willow scrub’ - in Natural England’s Priority Habitat Inventory.* |
| Are you performing a prioritisation exercise, i.e. would you like to prioritise extra protection of existing habitat or restoration of degraded habitat? [No = perform *Flow* only; Yes = perform *Dropping*] | *No – we are purely interested in how species may move through existing habitat, rather than in identifying the priority sites for further protection/restoration.* |
| Who will be interested in the results, i.e. target audience? Why? | *English/UK conservation organisations – to guide efforts in habitat conservation by highlighting key routes through the landscape where habitat is performing a connecting function that may not have been recognised before. This may help inter-regional co-operation on preserving links, and assist in operationalising policies such as the ‘nature recovery network’* |

1. *Dropping* analysis – Sabah case study

|  |  |
| --- | --- |
| What kind of species are you interested in? | *A tropical forest-dependent species with mid-range (4km) dispersal ability, e.g. a forest butterfly.* |
| Why do your species need to move between the focal source(s) and target(s)? | *To track climate change – temperatures that are now typical of lowland protected areas (PAs) in Sabah are predicted to occur at higher elevation in c.2080. For long-term resilience we think species will need to move from lowland protected areas to Mount Kinabalu. Protected Area 2 (PA2) and PA4 are used as exemplar lowland protected areas from which species are expected to move out.* |
| What constitutes habitat for those species within the landscape? | *Rainforest – for this exercise we used freely available forest cover data from* [*Gaveau et al. (2016)*](https://www.cifor.org/library/6227/rapid-conversions-and-avoided-deforestation-examining-four-decades-of-industrial-plantation-expansion-in-borneo/)*.* |
| Are you performing a prioritisation exercise, i.e. would you like to prioritise extra protection of existing habitat or restoration of degraded habitat? [No = perform *Flow* only; Yes = perform *Dropping*] If yes, how will you classify the landscape into baseline habitat (that you assume will not change in future) and the prioritisation layer (which may or may not be habitat in future)? | *Yes - we would like to prioritise extra protection of the forest which currently exists outside protected areas (PAs), because this may be vulnerable to deforestation in future.*  *Initially we will look at preserving the most important habitat for connecting two lowland PAs with Mount Kinabalu, without having a specific limit on the land area available for extra protection. All protected forest will go into the baseline habitat layer, and all unprotected forest into the prioritisation layer.* |
| Who will be interested in the results, i.e. target audience? Why? | *Conservation NGOs and government departments – to inform where their efforts to avoid deforestation in future should be focussed. In particular, to provide evidence for which unprotected areas of rainforest contribute the most to current connectivity and therefore would have the greatest connectivity “cost” if they were deforested, making them high priority for protection.* |

There is space below should you wish to fill-in your own answers.

|  |  |
| --- | --- |
| What kind of species are you interested in? |  |
| Why do your species need to move between the focal source(s) and target(s)? |  |
| What constitutes habitat for those species within the landscape? |  |
| Are you performing a prioritisation exercise, i.e. would you like to prioritise extra protection of existing habitat or restoration of degraded habitat? [No = perform *Flow* only; Yes = perform *Dropping*] If yes, how will you classify the landscape into baseline habitat (that you assume will not change in future) and the prioritisation layer (which may or may not be habitat in future)? |  |
| Who will be interested in the results, i.e. target audience? Why? |  |

# Preparing data for Condatis

The data layers/values that are required for running a Condatis analysis are shown below, along with a brief description of how to create each input. The *Flow* analysis is the most basic type for analysing a single landscape configuration (see the first exercise below). The *Dropping* analysis takes some additional inputs and gives some additional outputs (see second exercise below), as well as giving flow outputs for the baseline landscape and the maximal landscape (with all baseline and proposed habitat). Raster layers (starred in the table below) can be created in QGIS, ArcGIS, R or other packages. (For more information on the data types and guidance on preparing raster files, see the online [Help Documentation](http://www.webapp.condatis.org.uk/help/help.html).)

|  |  |
| --- | --- |
| Data layer/PARAMETER | Explanation |
| Reproductive Rate | Derived from ground data/expert knowledge; measured in individuals per km2. |
| Dispersal Distance | Derived from ground data/expert knowledge; measured in km. |
| Habitat\* | Raster, in geographical .tif format, where cells have a value between 0 and 1, according to the quantity/quality of habitat within each cell, and geographical co-ordinates are measured in metres. |
| Source and Target\* | Raster, in geographical .tif format of the same spatial resolution and coordinate system as the *Habitat* layer, where source grid cells (pixels) are given a value of ‘1’; target cells ‘2’. |
|  |  |
| A *Dropping* analysis also needs: |  |
| Prioritisation layer\* | Raster similar to the *Habitat* layer, which can represent habitat that does not currently exist, but where restoration is possible, or unprotected habitat that you may plan to conserve. |
| Stages | Choose how many analysis stages is appropriate given the desired specificity of results (better with more stages) and time available for analysis (slower with more stages). |
| Stage type | The two options are: (i) *Number based (equal number of cells dropped in each stage)*, or (ii) *Flow based (equal proportion of flow dropped in each stage)*. The number based output may be simpler, for ranking the landscape into broad bands, but the flow based output gives more detail in the high-flow areas, which we think may be more useful when you can only afford to protect/restore a very small proportion of the additional habitat. |

# GIS Layers provided

The geospatial layers for the *Flow* and *Dropping* demonstration analyses are listed below and can be found within the *CaseStudies.zip* package.

## Condatis *Flow* Inputs

|  |  |  |
| --- | --- | --- |
| **Folder** | **File name (.tif unless stated)** | **Condatis input** |
| SourceTarget | Eng\_SN | *Source and Target Layer* |
| Habitat | HeathEng1km | *Habitat Layer* – for Flow |

## Condatis *Dropping* Inputs

|  |  |  |
| --- | --- | --- |
| **Folder** | **File name (.tif unless stated)** | **Condatis input** |
| SourceTargets\* | SourceTarget2  SourceTarget4 | *Source and Target Layers* |
| Habitat | Forestundrop | *Habitat Layer* – for Dropping |
|  | Forestdrop | *Prioritisation Layer* – for Dropping |
|  | ForestEx1 | *Maximal Habitat Layer* – could be used for Flow analysis if wanted |
| Contextual\_layers | ProtectedAreas\_Malaysia.kml | N/A – for results interpretation in GIS |
|  | ForestBorneo30m |  |
|  | AnnualMeanTemp |  |
|  | Altitude\_Borneo\_1km |  |

## Condatis Outputs

The following output files can be used to check your own Condatis outputs:

* *Outputs-FLOW* folder for both case studies
* *Outputs-DROPPING* folder for PAs 2 and 4 for the Sabah case study only

# FLOW analysis example

See section 2 for the rationale behind this example. Follow the *Condatis Case Studies for FLOW and DROPPING analyses* slides to log into Condatis and try this analysis for yourself. If desired, record the names of the files and parameters that you are using.

|  |  |
| --- | --- |
| Data layer/PARAMETER | File name/VALUE |
| Source and Target |  |
| Habitat |  |
| Reproductive Rate (individuals per km2) |  |
| Dispersal Distance (km)\* |  |

\* *Between yourself and your neighbour, try two theoretical dispersal distances, e.g. 5km/10km, so results can be compared*

## Results – FLOW

Follow the *Condatis Case Studies* slides as above, to guide you through downloading your results. Look at them and compare with your neighbour. We will then discuss how to interpret the key outputs as a class. Record notes below to help you remember where to find results and what to look for when interpreting them.

|  |  |  |
| --- | --- | --- |
| OUTPUTS | where to find it (File and/or figure in html report) | interpretation |
| Flow map |  |  |
| Progress map |  |  |
| Overall speed |  |  |

## Conclusions from *Flow* analysis

By performing these two *Flow* analyses you can observe how the distance an individual can disperse affects the pattern of range shifting across the landscape between the source and the target habitat, as well as the overall speed. When you have looked at both sets of results, think about their similarities and differences, and the conservation conclusions.

|  |  |
| --- | --- |
| Which are the most important connectivity pathways for our species of interest? |  |
| Is the connectivity pattern affected by dispersal distance? In what ways? |  |

Note down any considerations you have for improving future Condatis analyses.

|  |  |
| --- | --- |
| Comments on any processes that did/did not work as expected: |  |
| Will you re-run the analysis? Why? |  |

## Data Presentation - FLOW

For your chosen target audience, consider how you would present the data to get across the most important results you found above.

|  |  |
| --- | --- |
| How will you present the data to your target audience? |  |
| What, if any further analysis is needed to answer your original research question(s)? |  |

# DROPPING analysis example

See section 2 for the rationale behind this example. Follow the presentation guidance to log into Condatis and try this analysis for yourself. If desired, record the names of the files and parameters that you are using.

|  |  |
| --- | --- |
| Data layer/PARAMETER | File name/VALUE |
| Source and Target |  |
| Habitat |  |
| Reproductive Rate (individuals per km2) |  |
| Dispersal Distance (km) |  |
| Prioritisation layer |  |
| Stage type *(circle choice)* | 1. *Number based (equal no. of cells dropped/stage)* 2. *Flow based (equal proportion of flow dropped/stage)* |
| Dropping Stages *(circle choice)* | Maximum (one cell dropped at a time)  1000  100 (recommended)  50  10 (rough guide) |

## Results - DROPPING

Follow the presentation guidance to download your results. Look at them and compare with your neighbour. We will then discuss how to interpret the key outputs as a class. Record notes below to help you remember where to find results and what to look for when interpreting them.

|  |  |  |
| --- | --- | --- |
| OUTPUTS | where to find it (File and/or figure in html report) | interpretation |
| Reduction in speed |  |  |
| Trajectory of dropping |  |  |
| Dropping Rank map |  |  |
| Step Dropping Summary |  |  |
| Speed loss map |  |  |

Write down the names of the output figures from your Condatis analyses, as shown in the results html, and describe your initial interpretation of the results. Repeat this for the other *Dropping* analysis, e.g. using PA4 (protected area 4) as the source instead of PA2.

## Conclusions from the *Dropping* analysis

By performing these two *Dropping* analyses you will be able to observe where common connectivity routes from both source protected areas (PA2 and PA4) might be, and therefore the priority habitats for conserving under a limited budget. Discuss your conservation conclusions and make notes below.

|  |  |
| --- | --- |
| Where is the most important unprotected habitat for enabling populations to move from both source PAs to Mount Kinabalu? |  |
| Could a high proportion of connectivity be preserved with a small proportion of the habitat? |  |
| Could one corridor be effective for both source PAs? |  |

Note down any considerations you have for improving future Condatis analyses.

|  |  |
| --- | --- |
| Comments on any processes that did/did not work as expected: |  |
| Will you re-run the analysis? Why? |  |

## Data Presentation - DROPPING

For your chosen target audience, consider how you would present the data to get across the most important results you found above.

|  |  |
| --- | --- |
| How will you present the data to your target audience? |  |
| What, if any further analysis is needed to answer your original research question(s)? |  |



# Feedback & information

Once you have completed the training, please provide us with advice on how we might improve the workshop in the future by filling out the Feedback Form. If you require further assistance in using Condatis or would like to be added to the Condatis Network mailing list, please email [contact@condatis.org.uk](mailto:contact@condatis.org.uk).

This worksheet was developed by Lydia Cole, Jenny Hodgson and Kath Allen. We would like to thank [NERC](https://nerc.ukri.org/) for supporting this training, and Drs Jamie Alison and Sarah Scriven for their help with providing the data for these case studies.

# Copyright & Citation

The html file reporting the results of your Condatis analysis has more information on copyright for the inputs and outputs from running a job. It also contains information on how to cite the software; please include a reference to Condatis in your work wherever it is appropriate. We would appreciate it if you could let us know how you are using Condatis so that we can report on its application in future grant applications and impact reporting. Please email us, and ideally send a copy of any publications to [contact@condatis.org](mailto:contact@condatis.org).uk.

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