

Getting the most out of Condatis: training workshop introduction 14 July 2026

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UNIVERSITY OF LIVERPOOL

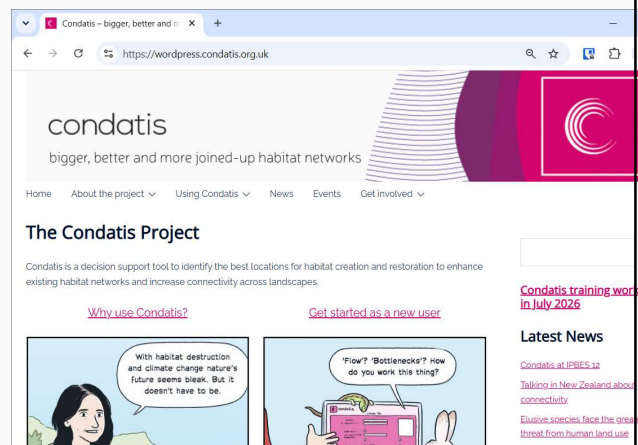
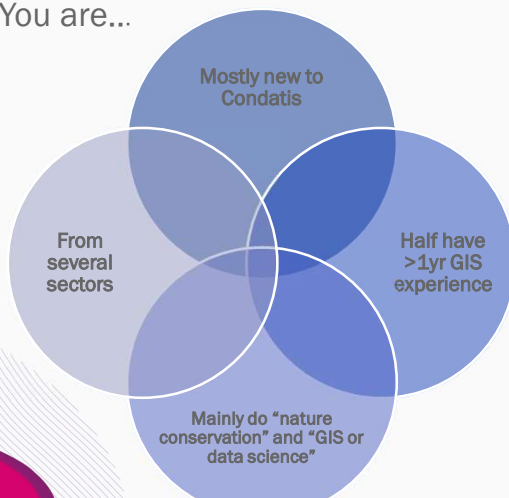


Acknowledgements to:
Claudia Gutierrez-Arellano, John Heap, Lydia Cole, Sarah Scriven, Tom Travers,
Jamie Alison, Georgia Carr, Ricardo Torres, Jordan Jones

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Welcome!

- We are Jenny Hodgson, Georgia Carr, Ricardo Torres and Jordan Jones
- You are...



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Housekeeping

I will start with some introductory slides to explain Condatis principles (about 10 minutes).

You should have received basic instructions to prepare you, **including the need to create an account on the web app.**

All the training materials you need today will be found here:

https://condatis.github.io/Ctraining_inR_25/

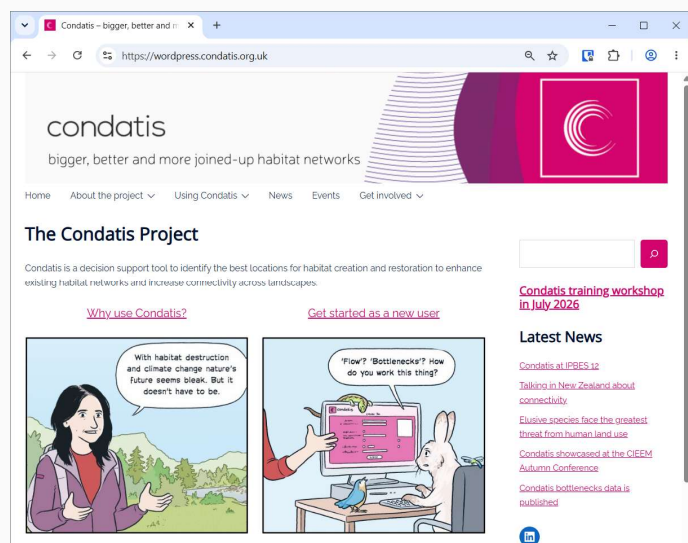
- We have different experience levels but we are all here to learn. All questions are worth asking. You are encouraged to help each other.
- Please mute your mic whenever not speaking, to avoid noise.
- Please place short questions in the chat feed. You can elaborate on them verbally when useful.
- If you lose your connection to Teams you can email Ricardo
- We have a breakout room for 1:1 help with Georgia

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Condatis is a web application and a science-practice partnership

- Project started 2013
- Thanks to many partners!
- In this talk: why was Condatis needed?
- How can Condatis support landscape decisions?

Find out more:
www.condatis.org.uk



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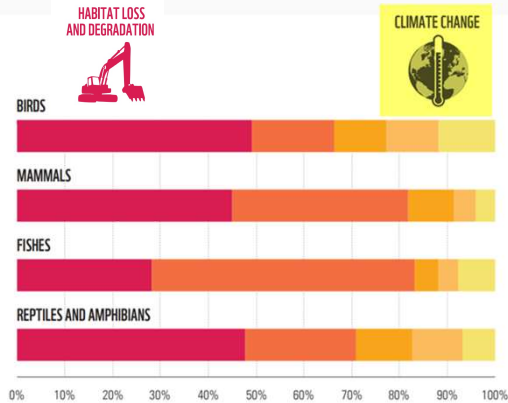
Why needed? To tackle interacting threats habitat loss and climate change

Figure 15: Relative frequency of major threats by taxonomic group

Threat data is available for 3,789 populations in the global LPI database. Each of these populations could be associated with up to three different threats. There were 6,053 threats recorded in all⁹⁸.

Key

- Habitat degradation/loss
- Exploitation
- Invasive species and disease
- Pollution
- Climate change



WWF. 2018. Living Planet Report - 2018: Aiming Higher. Grooten M, Almond R (Eds.)
WWF, Gland, Switzerland

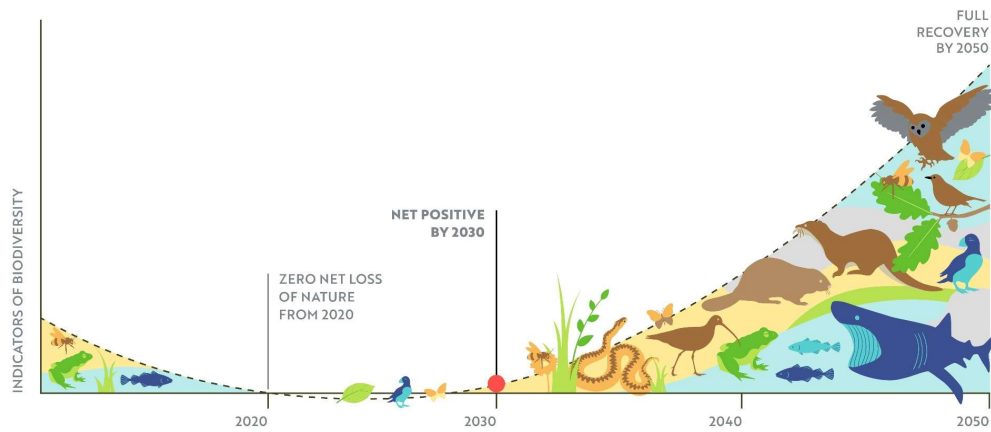
5

Range-shifting through fragmented landscapes is a challenge



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'Nature-positive 2030' a great ambition, but how to get there?



• <https://www.wcl.org.uk/a-world-richer-in-nature.asp>

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One solution is better connected networks



Designed by Kendra Hoff in Hilly et al. (2020). Guidelines for conserving connectivity through ecological networks and corridors. Best Practice Protected Area Guidelines Series No. 30. Gland, Switzerland: IUCN

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Policies are already aiming for large-scale restoration, e.g.



The Nature Recovery Network includes:

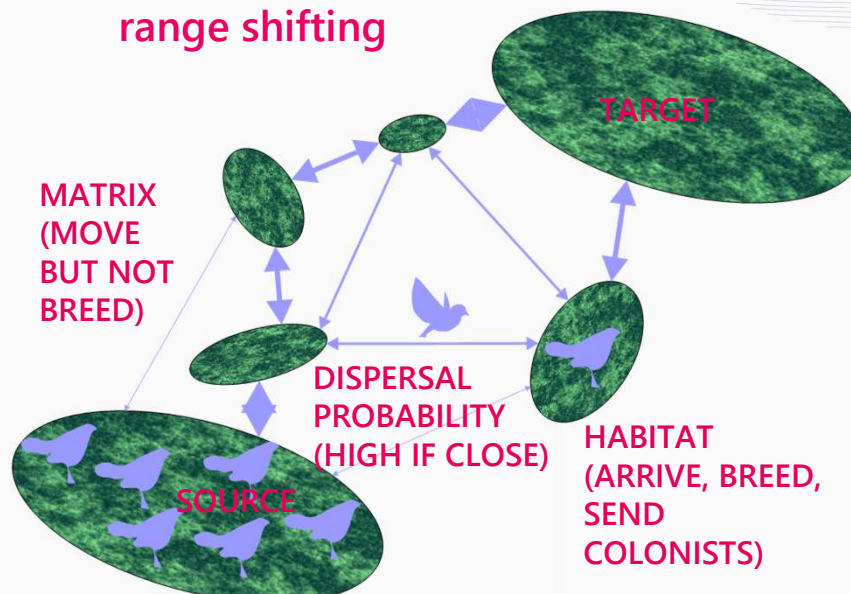
- Protected sites (recovery actions)
- Other wildlife-rich habitat (500,000 hectares created or restored by 2042) of outside the protected site network
- Woodland planting (180,000 hectares in England)

- But there are still many outstanding questions about targeting the restoration

Defra. (2018). A Green Future: Our 25 Year Plan to Improve the Environment.
<https://www.gov.uk/government/publications/25-year-environment-plan>

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Condatis models the speed of range shifting



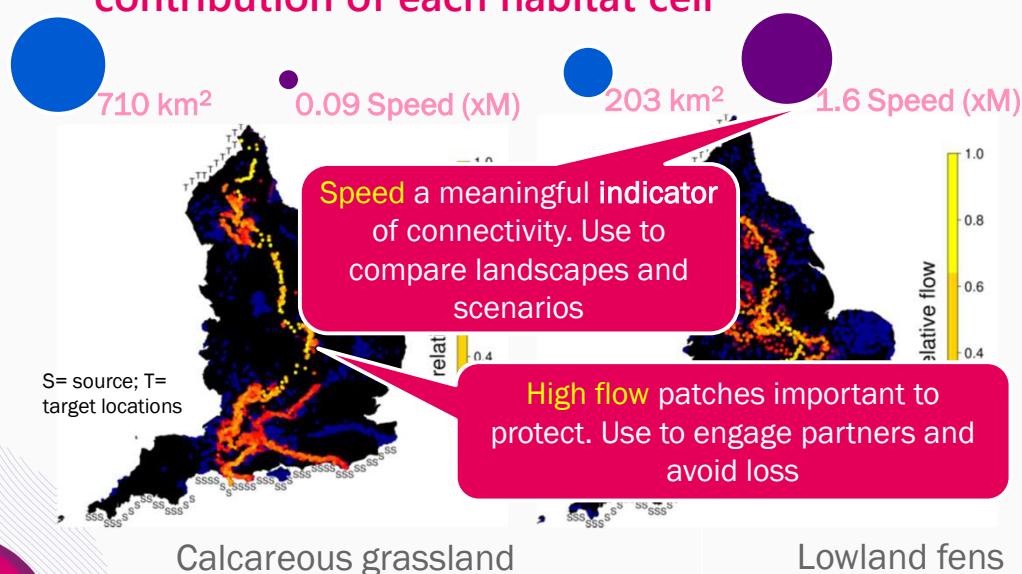
10

Thanks to this underlying range-shift model, we can:

- Highlight pathways across a landscape that allow both dispersal and reproduction of species;
- Pinpoint bottlenecks in the habitat network, where there are restricted opportunities for colonisation, and where restoration would be most impactful;
- Rank any feasible sites for habitat restoration, to efficiently enhance the existing habitat network
- It's easiest to show what this means with examples...

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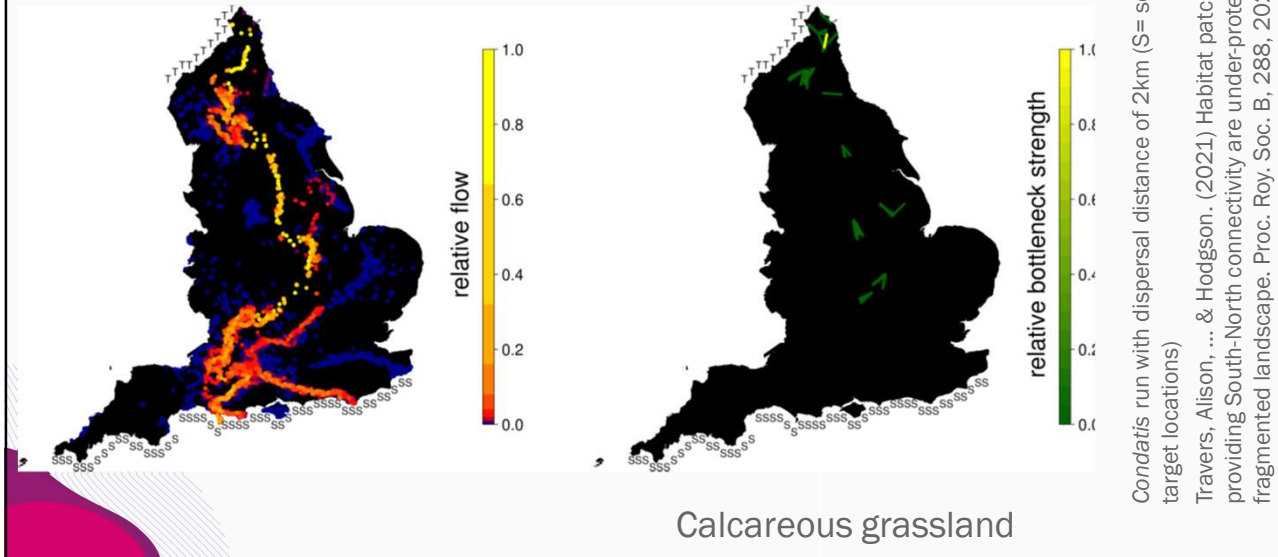
Speed scores the whole network, flow shows contribution of each habitat cell



Condatis run with dispersal distance of 2km
Travers, Alison, ... & Hodgson. (2021) Habitat patches providing South-North connectivity are under-protected in a fragmented landscape. Proc. Roy. Soc. B, 288, 20211010.

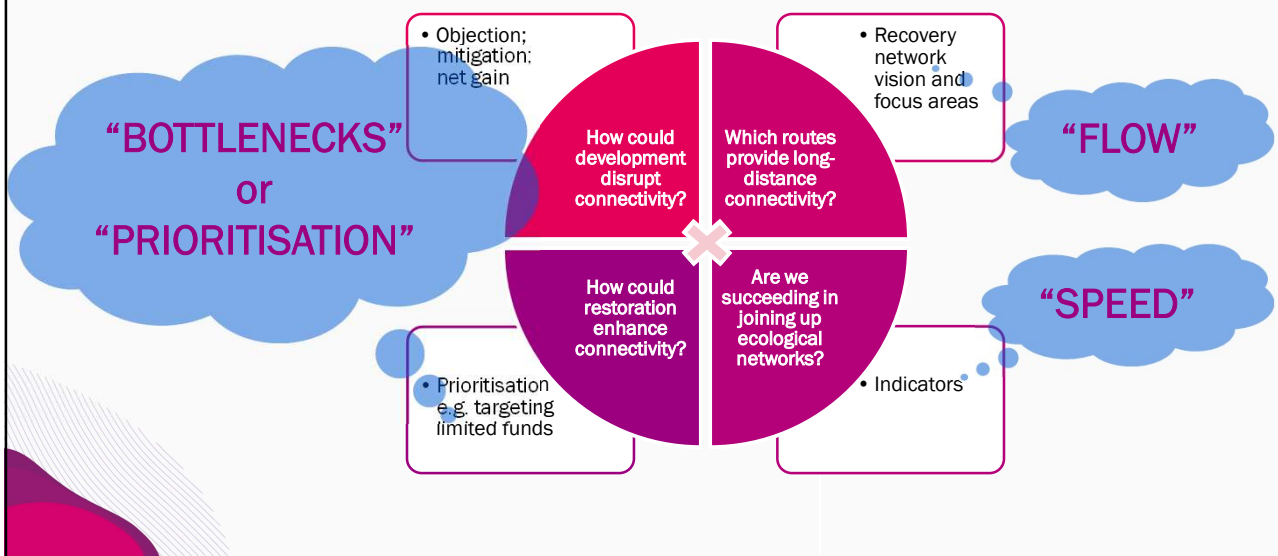
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Bottlenecks are 'difficult jumps' where flow is restricted: target restoration here



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Several ways Condatis can support landscape decisions



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How is prioritisation by dropping different from bottlenecks?

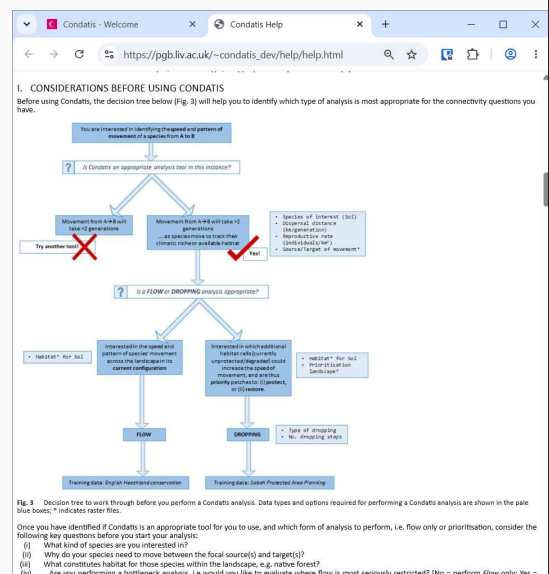
	Bottlenecks	Prioritisation by dropping
Purpose	Pinpoint problematic gaps in the existing habitat network	Rank user-defined candidate cells for restoration
Role of feasibility prior knowledge	Ignores feasibility for restoration	User can restrict candidates to land feasible for restoration
Most useful for	Suggesting the short-term, "next best" place to restore. Or if the restoration budget is very low in comparison to the number of candidate areas.	Planning a connected suite of sites. Or whenever the candidate areas are of limited extent and well-known
Analysis burden	Low – as quick as calculating flow only	Can be high

We will run an example in the web app, and this will become clearer

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If this brief intro has not covered enough...

- New, improved page on how Condatis works
<https://wordpress.condatis.org.uk/using-condatis/how-condatis-works>
- New page of key features with examples
<https://wordpress.condatis.org.uk/using-condatis/why-use-condatis>
- The web app's help, especially the flow diagram and the glossary
https://pgb.liv.ac.uk/~condatis_dev/help/help.html



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Objectives for today

- A. Learn how to use the Condatis web app, with an example about protecting additional rainforest in Sabah, Borneo
- B. Learn how to use Condatis in R, with an example of 'search zones' around bottlenecks in Eastern England

09:00	Introduction to Condatis
Now	Web App tour and explaining the Sabah exercise
9:30	Sabah exercise running, viewing outputs in GIS, with help as needed
10:20	Condatis Bottlenecks introductory presentation
10:30	Break
11:00	Condatis Bottlenecks Eastern England exercise in R
11:50	Recap; Q&A and requests; feedback survey
12:10	According to requests, either explore Condatis outputs further in GIS, or discuss applications for your own work

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Get ready to start

- Navigate to: https://condatis.github.io/Ctraining_inR_25/
- Download the whole repository as zip, unzip it
- Log into <https://webapp.condatis.org.uk/> (hopefully you created an account already)
- Open the quick reference document for the Sabah exercise (Web_app_quick_reference.pdf)

Any questions at this point?

Quick reference sheet for the Condatis web app exercises

Jenny Hodgson

PART OF THE WORKSHOP: CONDATIS CONNECTIVITY ANALYSIS TO PLAN RESILIENT HABITAT NETWORKS, SEPTEMBER 2025

General outline for any Condatis web app analysis

1. Open Condatis webpage & sign in
2. Create new job
3. Choose correct type of analysis, e.g. include prioritisation
4. Fill out data input boxes
5. Check job information and confirm the submission after the 'pre-flight' check
6. You can log out if needed and your job will continue to be processed
7. Open Results html page
8. Download zip file

Sabah example with protected areas and unprotected forest

We will perform two example analyses:

1. **Flow/bottlenecks analysis** asks: How easy is it currently for forest species to travel from lowlands to mountains in Sabah? Where are the bottlenecks?
2. **Prioritisation analysis** asks: Which currently unprotected forest habitats are priority for long-term connectivity between our lowland protected area and Mount Kinabalu?

Flow/bottlenecks analysis

Settings:

Data/files	Name
Folder	sabah_data
Habitat layer	ForestEx1.tif
Source/target layer	SourceTarget1.tif
Reproductive rate	2000 individuals per km ²
Dispersal distance	1.5 km

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Our first example – Sabah, Borneo – based on a large conservation planning study

Conservation Biology



Contributed Paper

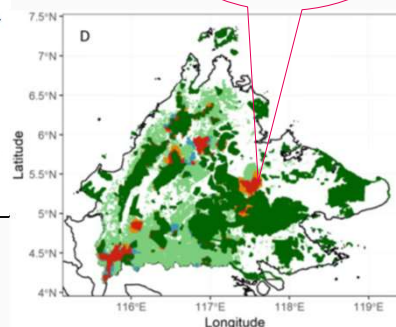
Incorporating connectivity into conservation planning for optimal representation of multiple species and ecosystem services

Sara H. Williams, Sarah A. Scriven, David F. R. P. Burslem, Jane K. Hill, Glen Reynolds, Agnes L. Agama, Frederick Kugan, Colin R. Maycock, Eyen Khoo, Alexander Y.L. Hastie, John B. Sugau, Reuben Nilus, Joan T. Pereira, Sandy L.T. Tsen, Leung Y. Lee, Suzika Juiling, Jenny A. Hodgson, Lydia E.S. Cole, Gregory P. Asner, Luke J. Evans, Jedediah F. Brodie

... See fewer authors

First published: 15 December 2019 | <https://doi.org/10.1111/cobi.13450>

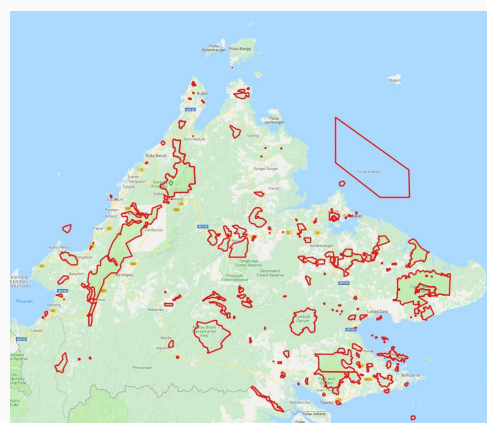
Article impact statement: New protected area design in Sabah, Borneo, reveals that connectivity can be used in planning without compromising other conservation goals. This article has been accepted for publication and undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as <https://doi.org/10.1111/cobi.13450>



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Enhancing Sabah's PA Network - Conservation & Management Questions

- As the climate gets hotter, which forested routes will populations take to move from lowland Protected Areas to suitable habitats on Mount Kinabalu?
- Given plans to protect more of Sabah's forest, which are the currently unprotected forest habitats that are a priority for long-term connectivity between lowland PAs and Mount Kinabalu?

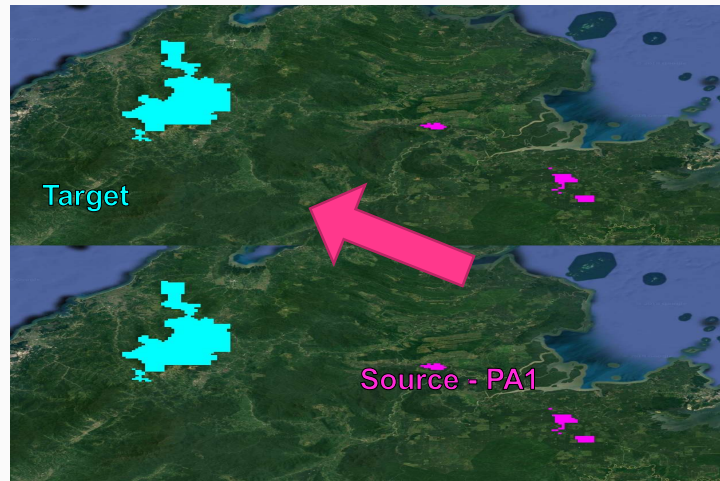


Sabah's Protected Areas

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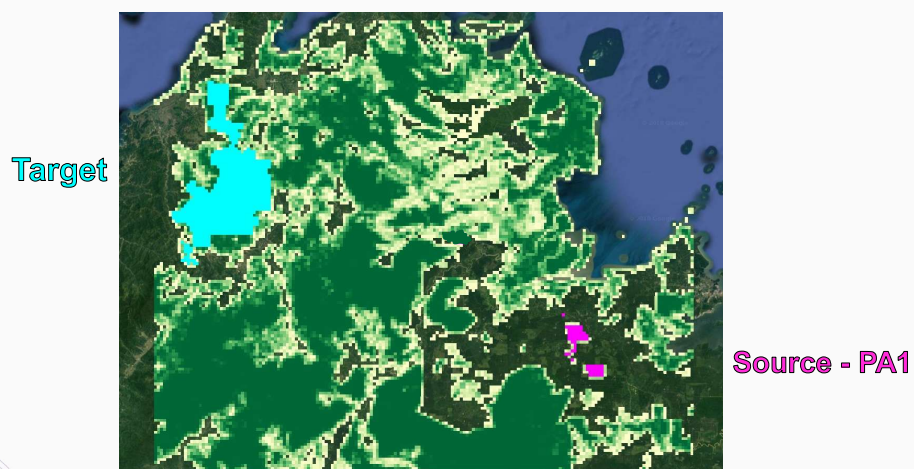
We take one case study Protected Area

- Lowland *source* to cooler, highland *target*, predicted to provide a refuge in 2080



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Habitat = Forest cover– mostly unprotected

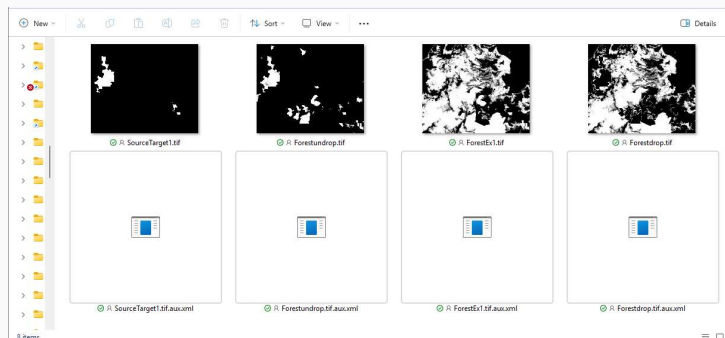


Forest cover (Gaveau *et al.*, 2016). Species of conservation concern assumed to move through forest habitat

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Two analyses – with provided data

- **Flow/bottlenecks analysis** asks: How easy is it currently for forest species to travel from lowlands to mountains in Sabah? Where are the bottlenecks?
 - A simple introduction to the web app - learning how to analyse flow with bottlenecks
- **Prioritisation analysis** asks: Which currently unprotected forest habitats are a priority for long-term connectivity between lowland protected areas and Mount Kinabalu?
 - We'll learn what 'Prioritisation by Dropping' does
- Find `sabah_data` folder



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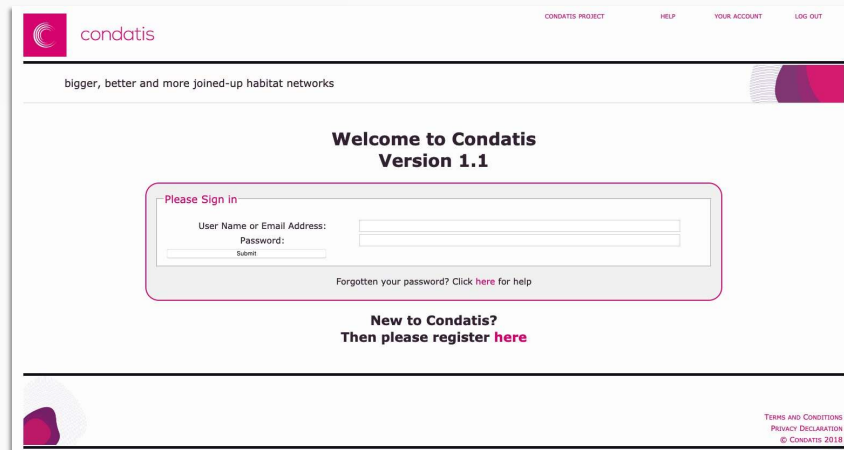
Note that in your own analyses, data preparation needs time and thought!

- https://condatis.github.io/Ctraining_inR_25/CondatisDataRequirements.pdf PDF helps you to understand the data requirements

condatis

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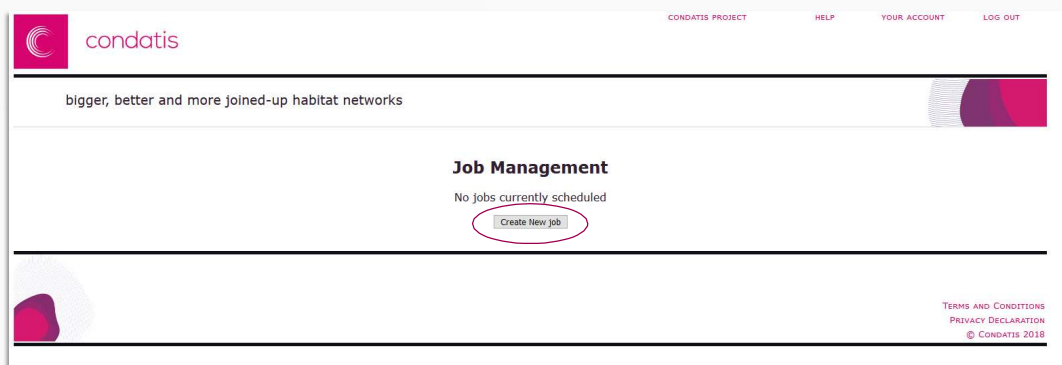
Running Condatis analysis – Log in to web app



The screenshot shows the Condatis login page. At the top, there is a navigation bar with the Condatis logo on the left and links for 'CONDATIS PROJECT', 'HELP', 'YOUR ACCOUNT', and 'LOG OUT' on the right. Below the navigation bar is a tagline: 'bigger, better and more joined-up habitat networks'. The main heading is 'Welcome to Condatis Version 1.1'. Below this is a 'Please Sign in' box containing two input fields: 'User Name or Email Address:' and 'Password:', with a 'Submit' button below them. A link 'Forgotten your password? Click here for help' is located below the password field. Below the sign-in box is a section for new users: 'New to Condatis? Then please register here'. At the bottom right, there are links for 'TERMS AND CONDITIONS', 'PRIVACY DECLARATION', and '© CONDATIS 2018'.

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Running Condatis analysis – Create a new job



The screenshot shows the Condatis Job Management page. It has the same navigation bar as the login page. Below the navigation bar is the same tagline: 'bigger, better and more joined-up habitat networks'. The main heading is 'Job Management'. Below this is the text 'No jobs currently scheduled'. A button labeled 'Create New job' is circled in red. At the bottom right, there are links for 'TERMS AND CONDITIONS', 'PRIVACY DECLARATION', and '© CONDATIS 2018'.

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Running Condatis analysis – setting parameters

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Inputs for simple flow/bottlenecks analysis

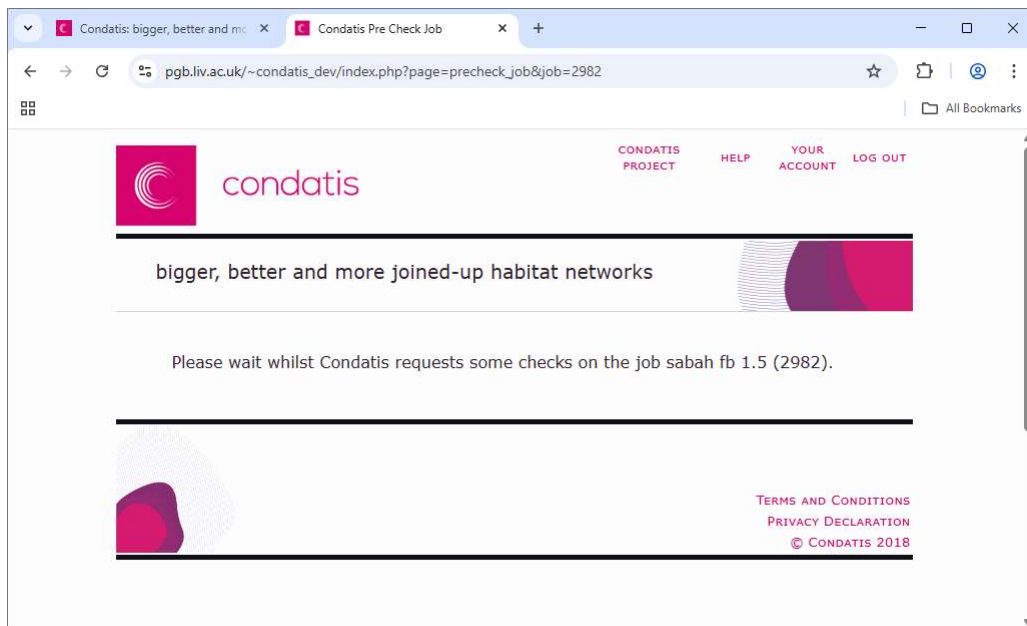
- The 'job name' will be used to name your downloaded files, so make it informative, but not too long



Data/files	Name
Folder	sabah_data
Habitat layer	ForestEx1.tif
Source/target layer	SourceTarget1.tif
Reproductive rate	2000 individuals per km ²
Dispersal distance	1.5km
Bottlenecks	Yes (up to 200)

This is the 'forest example', and includes both protected and unprotected forest

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Confirm submission after pre-flight checks

Now your turn!

- When most people have submitted jobs I will walk through the results
- Then we'll move on to 'prioritisation by dropping'



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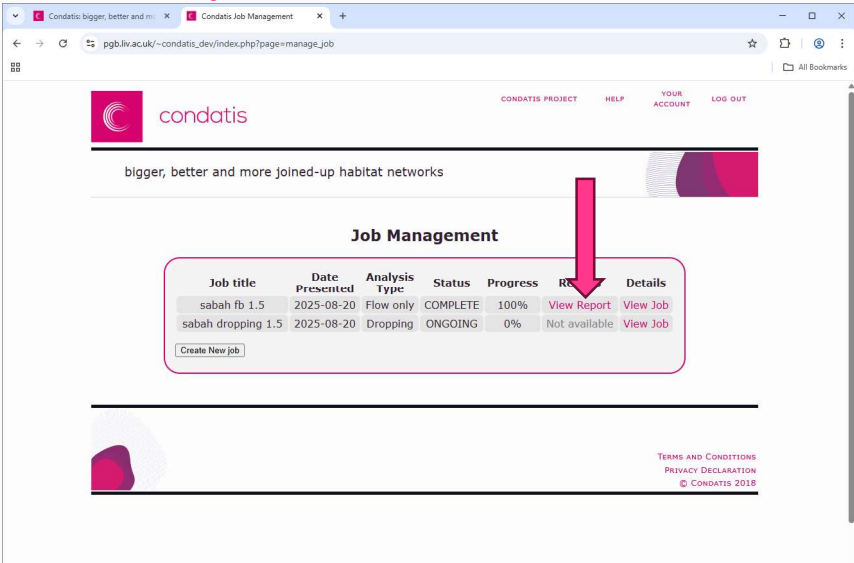
Condatis Web app analysis summary

- Follow along with https://condatis.github.io/Ctraining_inR_25/Web_app_quick_reference.pdf
- To be able to use the web app you will need to register with the website
- Once logged in you will be able to
 - Create a job
 - Fill in the relevant parameters
- Remember to select “bottlenecks” if you require the major barriers to dispersal to be reported
- Condatis will give you a position in queue and a progress % on analysis
- A summary will be provided when analysis is finished
- Data can then be downloaded and imported to GIS and/or statistical packages for exploration

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Job management page shows everything in progress and previously completed

- Click ‘View Report’ to get your results



The screenshot shows the Condatis Job Management interface. At the top, there's a navigation bar with the Condatis logo and links for 'CONDATIS PROJECT', 'HELP', 'YOUR ACCOUNT', and 'LOG OUT'. Below this, a banner reads 'bigger, better and more joined-up habitat networks'. The main section is titled 'Job Management' and contains a table with the following data:

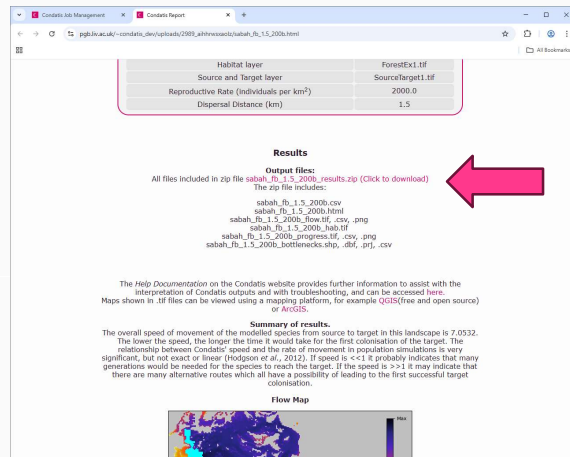
Job title	Date Presented	Analysis Type	Status	Progress	Report	Details
sabab fb 1.5	2025-08-20	Flow only	COMPLETE	100%	View Report	View Job
sabab dropping 1.5	2025-08-20	Dropping	ONGOING	0%	Not available	View Job

Below the table is a 'Create New job' button. A red arrow points to the 'View Report' link for the 'sabab dropping 1.5' job. At the bottom right, there are links for 'TERMS AND CONDITIONS', 'PRIVACY DECLARATION', and '© CONDATIS 2018'.

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Open Results html page & download zip files

- Overview maps are shown in the html summary, but the colour scheme isn't always the clearest
- Look at the interpretation legends to help understand the data
- The connectivity of this landscape is high (7), is this a surprise?



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Exploring the downloaded results

Condatis_workshop_example1.csv	05/03/2021 11:03	Microsoft Excel C...	30 KB
Condatis_workshop_example1.html	05/03/2021 11:03	Firefox HTML Doc...	9 KB
Condatis_workshop_example1_autoST.tif	05/03/2021 11:03	TIF File	45 KB
Condatis_workshop_example1_bottlenecks.csv	05/03/2021 11:03	Microsoft Excel C...	74 KB
Condatis_workshop_example1_bottlenecks.dbf	05/03/2021 11:03	DBF File	7 KB
Condatis_workshop_example1_bottlenecks.png	05/03/2021 11:03	PNG File	6 KB
Condatis_workshop_example1_bottlenecks.prj	05/03/2021 11:03	PRJ File	1 KB
Condatis_workshop_example1_bottlenecks.shp	05/03/2021 11:03	SHP File	2 KB
Condatis_workshop_example1_bottlenecks.shx	05/03/2021 11:03	SHX File	1 KB
Condatis_workshop_example1_flow.csv	05/03/2021 11:03	Microsoft Excel C...	23 KB
Condatis_workshop_example1_flow.png	05/03/2021 11:03	PNG File	10 KB
Condatis_workshop_example1_flow.tif	05/03/2021 11:03	TIF File	45 KB
Condatis_workshop_example1_progress.csv	05/03/2021 11:03	Microsoft Excel C...	23 KB
Condatis_workshop_example1_progress.png	05/03/2021 11:03	PNG File	8 KB
Condatis_workshop_example1_progress.tif	05/03/2021 11:03	TIF File	45 KB

- .html file is the same as the **summary** shown on the **website**
- .png files are the images displayed in the **summary**

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Exploring the downloaded results

Condatis_workshop_example1.csv	05/03/2021 11:03	Microsoft Excel C...	30 KB
Condatis_workshop_example1.html	05/03/2021 11:03	Firefox HTML Doc...	9 KB
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Condatis_workshop_example1_bottlenecks.png	05/03/2021 11:03	PNG File	6 KB
Condatis_workshop_example1_bottlenecks.prj	05/03/2021 11:03	PRJ File	1 KB
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Condatis_workshop_example1_bottlenecks.shx	05/03/2021 11:03	SHX File	1 KB
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Condatis_workshop_example1_progress.png	05/03/2021 11:03	PNG File	8 KB
Condatis_workshop_example1_progress.tif	05/03/2021 11:03	TIF File	45 KB

- .csv files are the raw data underlying the spatial outputs
- Provided for statistical analysis should you want to

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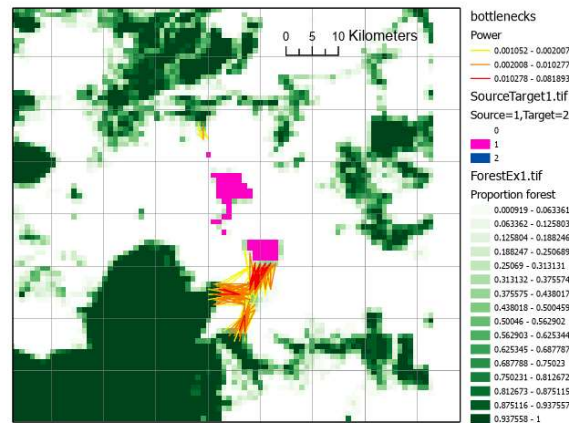
Exploring the downloaded results

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Condatis_workshop_example1_bottlenecks.prj	05/03/2021 11:03	PRJ File	1 KB
Condatis_workshop_example1_bottlenecks.shp	05/03/2021 11:03	SHP File	2 KB
Condatis_workshop_example1_bottlenecks.shx	05/03/2021 11:03	SHX File	1 KB
Condatis_workshop_example1_flow.csv	05/03/2021 11:03	Microsoft Excel C...	23 KB
Condatis_workshop_example1_flow.png	05/03/2021 11:03	PNG File	10 KB
Condatis_workshop_example1_flow.tif	05/03/2021 11:03	TIF File	45 KB
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Condatis_workshop_example1_progress.png	05/03/2021 11:03	PNG File	8 KB
Condatis_workshop_example1_progress.tif	05/03/2021 11:03	TIF File	45 KB

- .tif files and the bottlenecks shapefile can be opened in GIS

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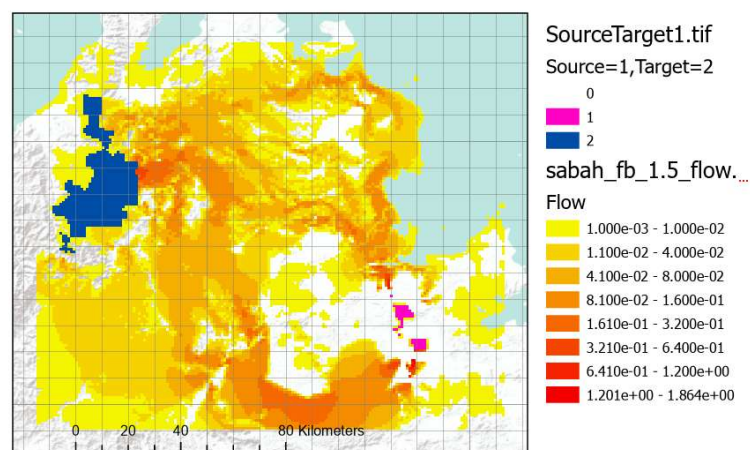
Bottlenecks and flow viewed in GIS



Notice all the bottlenecks are close to the source

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Bottlenecks and flow viewed in GIS



Notice flow is highest when there is little 'choice' about route to take. Where there is plenty of forest, flow spreads out and takes all routes

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Prioritisation – questions that can be addressed

- Conservation:
 - Of unprotected habitat that the population could move through, which areas are a conservation priority? i.e. we need to avoid losing them.
- Restoration:
 - In which areas would restoration be most beneficial to connectivity, out of identified feasible areas?
- Today, we're prioritising the unprotected rainforest in this area of Sabah. We're investigating 'worst case' future scenarios where unprotected forest is lost. Not because we expect it to happen, but in order to advise on efficient additional protection of corridors or 'climate change escape routes'.

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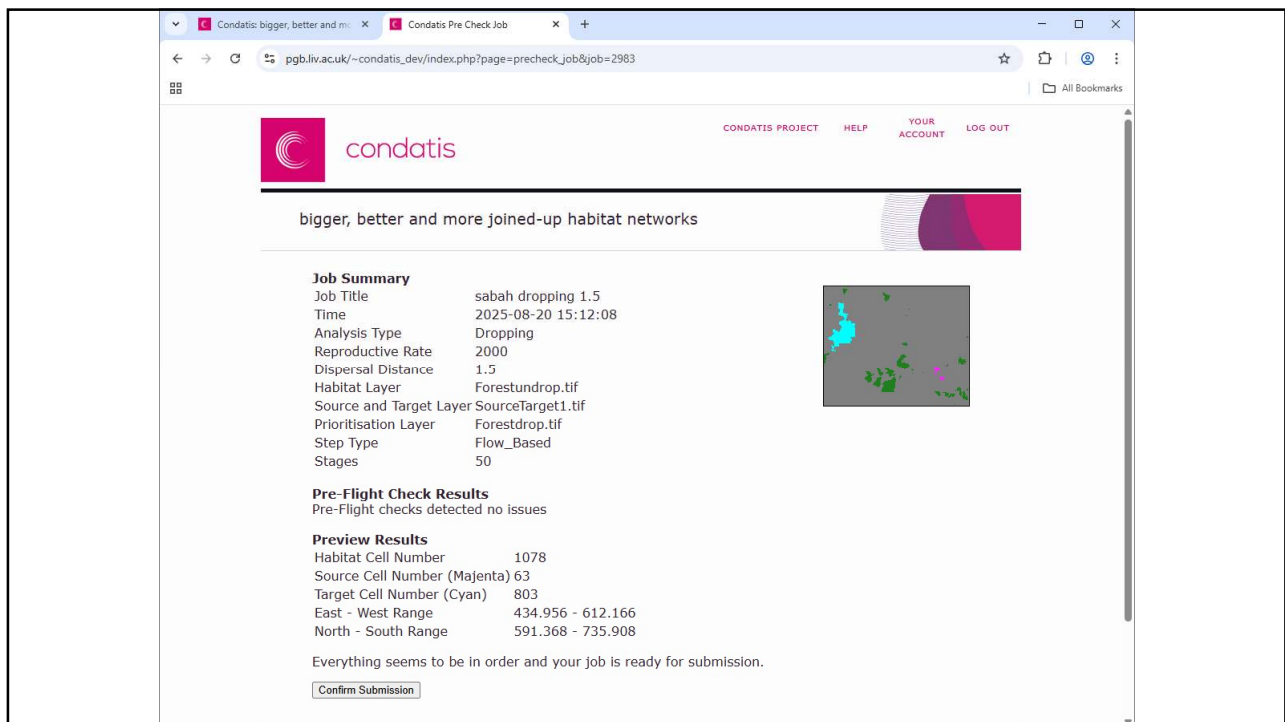
Inputs for Condatis – *Prioritisation* analysis

- We suggest some in the class choose 50 dropping stages (slower), and some choose 10

Data/files	Name
File package	sabah_data
Source/target layer	SourceTarget1.tif
Habitat layer	Forestundrop.tif
Prioritisation layer	Forestdrop.tif
Reproductive rate	2000 individuals per km ²
Dispersal distance	1.5 km
Bottlenecks	No
Number of stages for dropping	10 (rough guide) or 50
Dropping stage Type	Flow based

We have separated protected and unprotected forest into two layers for you

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Overview of your results in html report

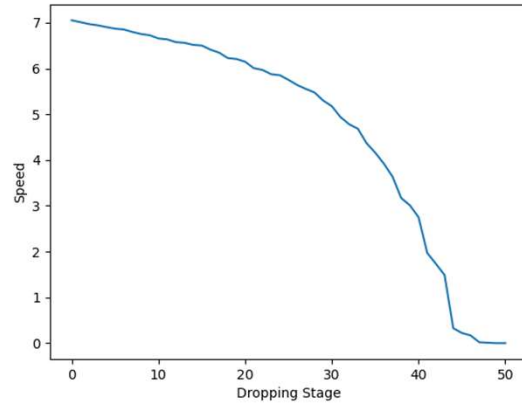
Start flow

Dropping rank – shows which ‘climate change escape routes’ are most efficient to conserve

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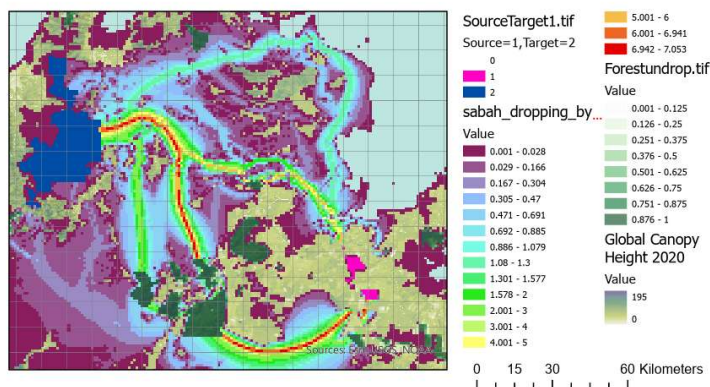
View the speed loss trajectory

- What impact does loss of habitat, i.e. dropping, have on speed of movement?
- How does speed change with each stage of dropping?



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Trajectory on a map – how much of the original speed has been lost by stage x?



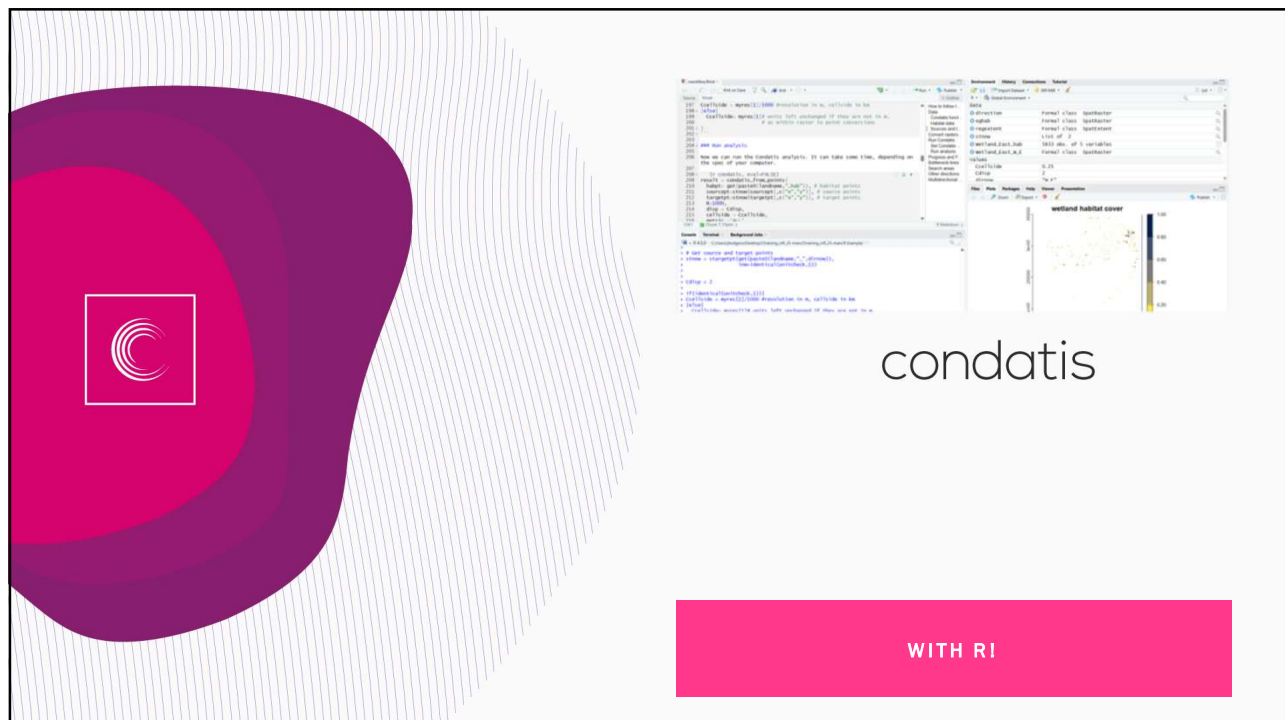
E.G. By retaining the yellow, orange and red areas we can keep speed loss no more than 4 (i.e. keep it above ~3 when it was originally ~7)

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Synthesis

- **Flow/bottlenecks analysis** asks: How easy is it currently for forest species to travel from lowlands to mountains in Sabah? Where are the bottlenecks?
 - We learnt how to analyse flow with bottlenecks
 - We saw some obvious features bottlenecks tend to have – bridging the worst gaps along a route that species are ‘forced’ to take if they are to reach the target
 - We noted that the bottlenecks in this particular landscape are difficult in practice to bridge
- **Prioritisation analysis** asks: Which currently unprotected forest habitats are a priority for long-term connectivity between lowland protected areas and Mount Kinabalu?
 - We learnt what ‘Prioritisation by Dropping’ does
 - The landscape starts with a high connectivity (“speed”), and it would be possible to preserve much of this with a small amount of conserved corridor forest
 - Just looking at flow alone in these landscapes would not have given such clear priorities of areas to save from logging
 - The end speed is virtually zero, because there are large distances between the existing protected areas

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The image is a composite. On the left is a stylized landscape graphic with concentric, irregular shapes in shades of purple and pink, set against a background of fine, radiating lines. In the center is a screenshot of the Condatis software interface, which displays a code editor with R script, a variable list on the right, and a small map titled 'wetland habitat cover'. Below the screenshot, the word 'condatis' is written in a lowercase, sans-serif font. At the bottom right, there is a solid pink rectangular box containing the text 'WITH RI' in white, uppercase letters.

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Why use R?

- New ways of processing bottlenecks are not available in the web app yet
- If you already use and like R, you can do entire workflows in the same place
- You can set up 'loops' with many related runs

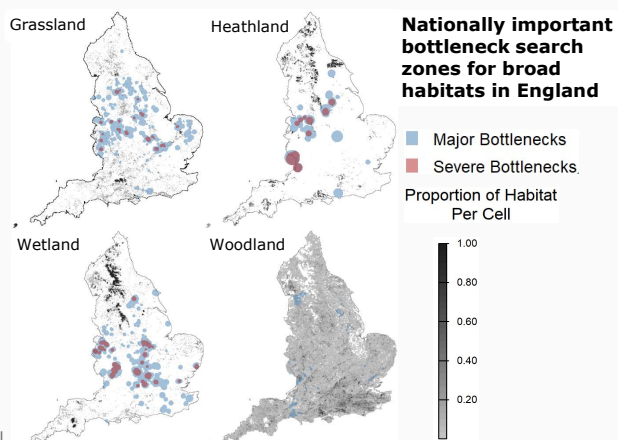
However!

- R on your PC will be limited to small network sizes
- There is less sanity-checking, more chance of doing something wrong

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Case study: important bottlenecks in England

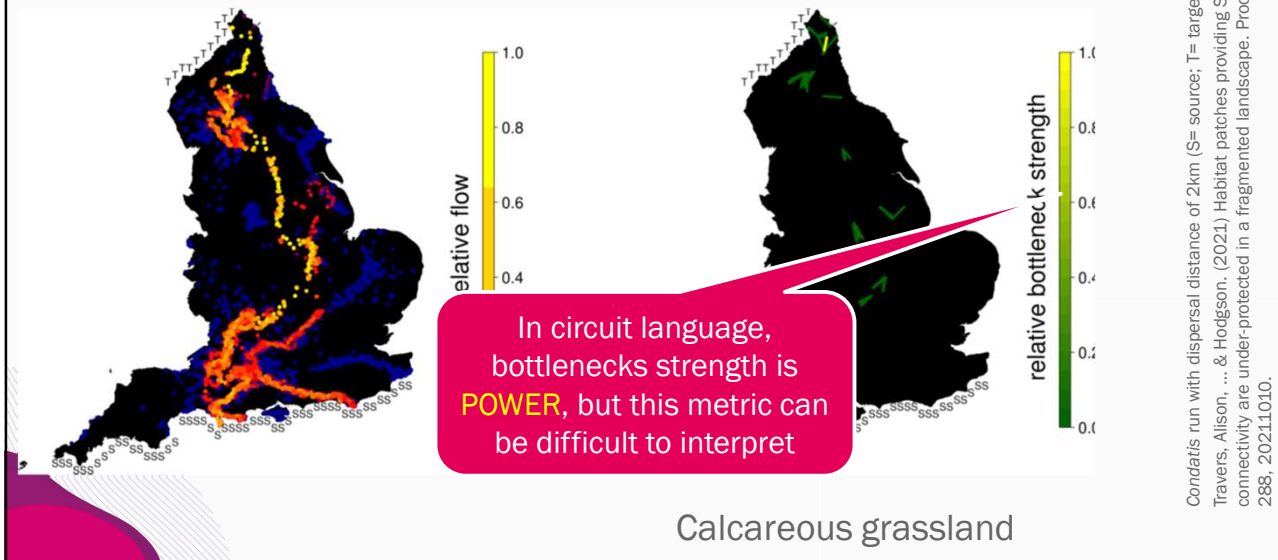
- In collaboration and funded by Natural England, 2023-4
- Aimed to inform Local Nature Recovery Strategies and other large-scale initiatives
- Used 4 broad seminatural habitat types from the Priority Habitats Inventory



Hodgson, J. A., Mungee, M., Gutierrez-Arellano, C., Taylor, S. D., Duffield, S., & Crick, H. Q. P. (2024). Condatis bottlenecks spatial data for broad habitat networks in England. Available at: <https://doi.org/10.7910/DVN/V17HXP>

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Reminder: bottlenecks are 'difficult jumps'
where flow is restricted



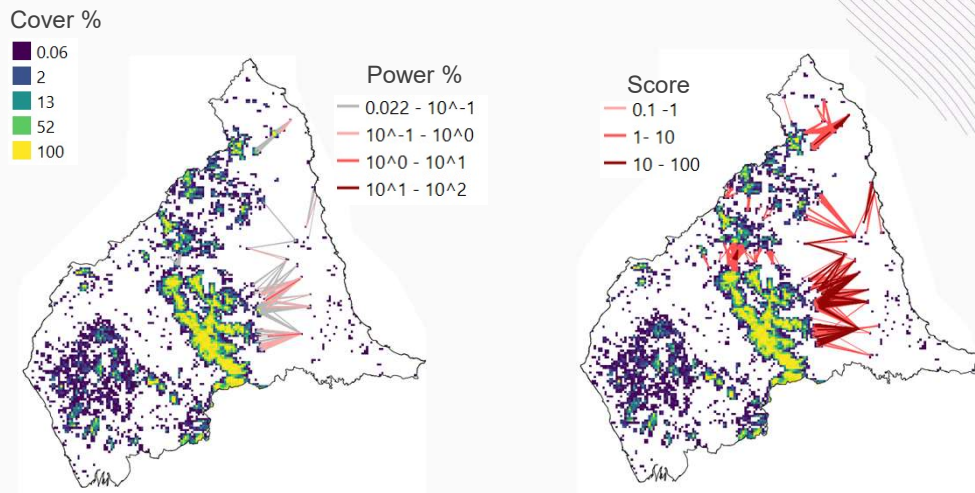
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Briefly, our new ideas for the bottlenecks project

- Convert 'percentage power' to 'bottleneck score'
 - Score is normalised by the number of cells, so better expresses what is 'disproportionately high'
- Convert clusters of bottlenecks lines into polygon 'search areas'
 - A more streamlined output for practitioners

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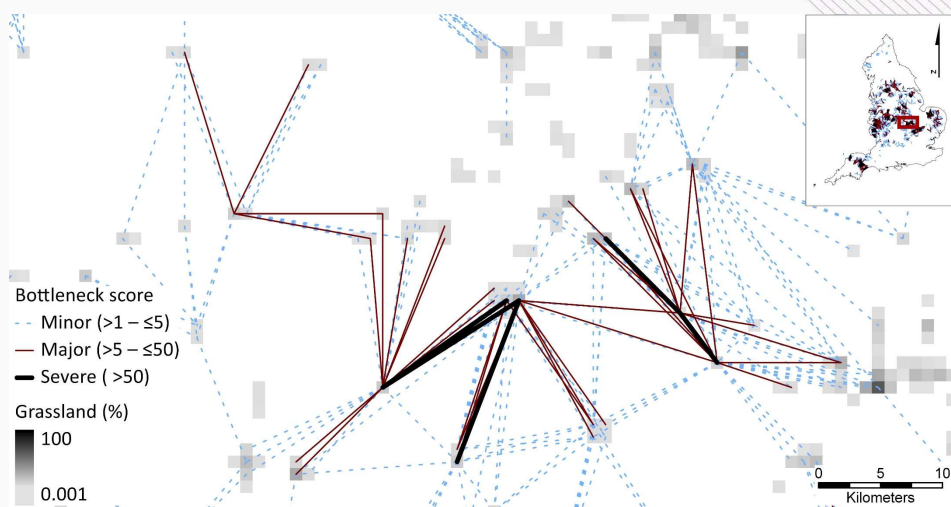
1) Power % becomes score



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Note that bottlenecks often occur in clusters



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2) Circles spanning bottlenecks become 'Search areas'

Gutierrez-Arellano, C., et al. 2023. Informing nature recovery in England by analysing "bottlenecks" in broad habitats [NECR499]. Natural England, York.



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Now your turn again, with R

- Under 'Session 2' in the schedule, you will find a link to https://condatis.github.io/Ctraining_inR_25/rworkflow
- This is a handy R Markdown file that steps you through everything you need to do

Any questions?

Condatis connectivity analysis

https://condatis.github.io/Ctraining_inR_25/rworkflow

How to follow the exercise

We will obtain the Condatis statistics, the raster layers for the *Flow* and *Progress* metrics, the shapefiles for the *Bottleneck links*, with their associated *power* and *score* metrics. Finally, we will obtain a the shapefile *Search Areas*, based on the score metric.

How to follow the exercise

You are looking at an R Markdown file, which has chunks of R code interspersed with instructions. You can either copy-paste the R code from your browser into R. Or, you can open the file 'Workflow.Rmd' in RStudio and choose 'run' next to each code chunk. Only the first chunk (setting the working directory) needs to be adapted to your local machine.

Data

The data required for this exercise are in the *R example* folder of the *Workshop GitHub repository*.

Set your working directory using the path where you downloaded the ZIP.

```
setwd("~/YOUR PATH/R example")
```

Condatis functions and R packages

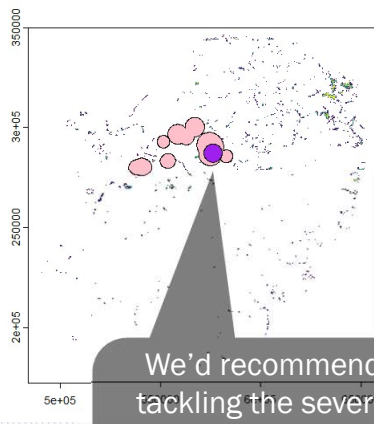
First, lets source the required functions and libraries for the analyses.

In this exercise we will use the following Condatis functions:

- `makehabitatpoints` Condatis runs calculations by converting each habitat patch (cell) into data points. This function converts habitat raster files into a data frame where each patch has *x/y* coordinates (in km) and a cover value (raster values)

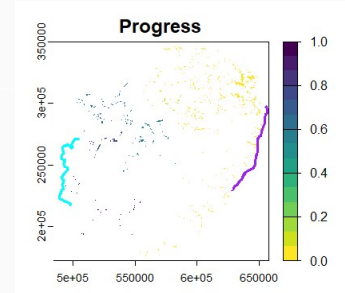
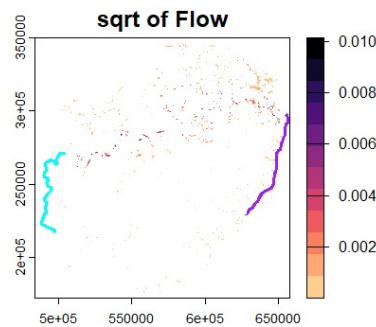
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Are the bottleneck search areas sensible?



Category
 Major
 Severe

- They are close to the route of high flow
- But within that route the species is 'forced' to make some long jumps
- The jumps are also visible as discontinuities in 'progress'



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Of course, analyses like these are only the beginning of your travels



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Get inspiration from earlier projects

See Using Condatis> Training Resources

Watch videos by users

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Thanks! Feedback welcome



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Thanks to many conservation partners and users who have helped make Condatis fit for purpose

Our software developers include: David Wallis, John Heap, Tony McCabe, Tom Travers and Claudia Gutierrez-Arellano

Find out more: www.condatis.org.uk



Natural Environment Research Council



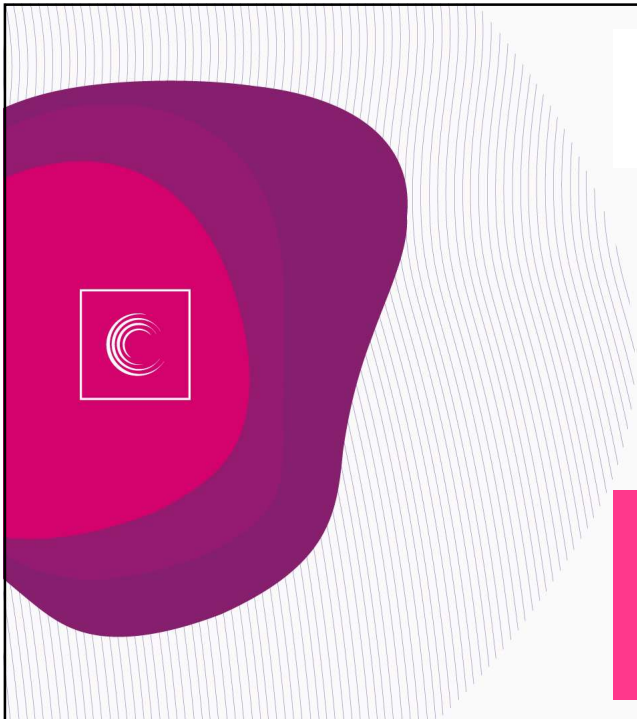
Future Leaders Fellowships



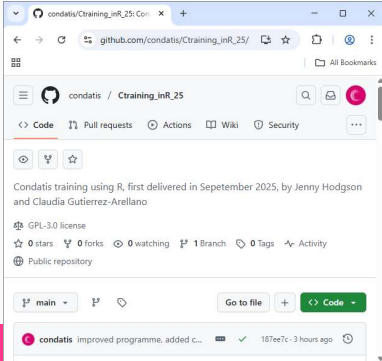
UNIVERSITY OF LIVERPOOL



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Download all today's materials:
[https://github.com/condatis/
Ctraining_inR_25/](https://github.com/condatis/Ctraining_inR_25/)



Access via schedule page:
[https://condatis.github.io/
Ctraining_inR_25/](https://condatis.github.io/Ctraining_inR_25/)