condatis

UNIVERSITY OF LIVERPOOL

NERC SCIENCE OF THE ENVIRONMENT

Condatis Demos for FLOW & PRIORITISATION analyses

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& KATH ALLEN

Activity

***FLOW** analysis 1*

As the climate gets warmer, which routes will woodland populations take through the proposed Northern Forest region?

- Perform a **Flow** analysis
- Interpret the results

***FLOW** analysis 2*

Which routes will heathland populations take to move from habitat patches in the south of England to those in the north? Where are the bottlenecks?

- Perform a **Flow** analysis including bottlenecks
- Interpret the results

***PRIORITISATION** analysis 3*

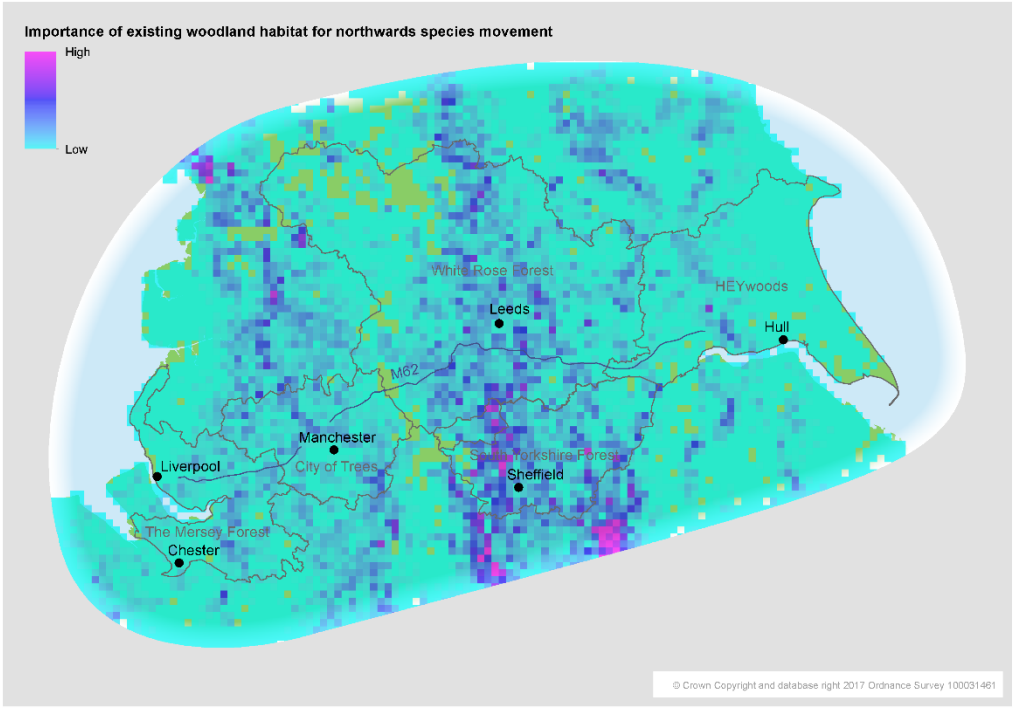
Given plans to protect more of Sabah's forest, which currently unprotected forest habitats tat are a priority for long-term connectivity between lowland protected areas and Mount Kinabalu?

- Perform a **Prioritisation by Dropping** analysis
- Interpret the results

FLOW 1 – Creating a connected Northern Forest

Conservation & Management Q:

Which are the main routes for woodland species moving from south to north, through the proposed Northern Forest region?



Original analysis for the Northern forest region by Tom Butlin, Mersey Forest (then using deciduous and conifer woodlands)

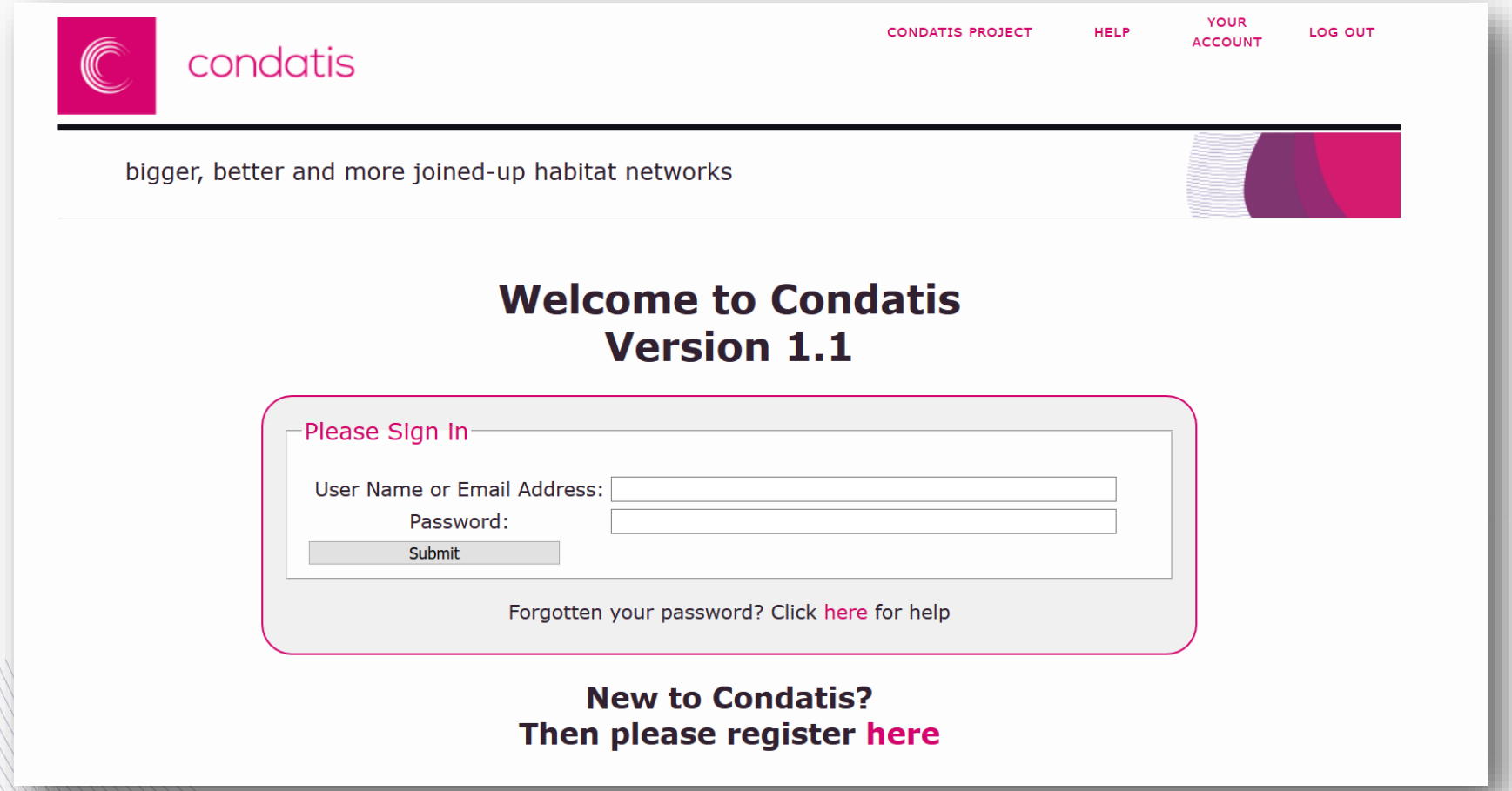
Inputs for Condatis – FLOW 1 analysis

Data/files	Name
File package	**Flow1** (folder)
Habitat layer	**pdwoodaroundNforest1km.tif**
Source/target layer	**Auto south-north**
Reproductive rate	**1000 individuals per km^2**
Dispersal distance	**1km**
Bottlenecks	**No**
Condatis “job” name	*e.g. pdwoodaroundNforest1kmFlow*

Look at your input layer in GIS before starting?

Running your analysis

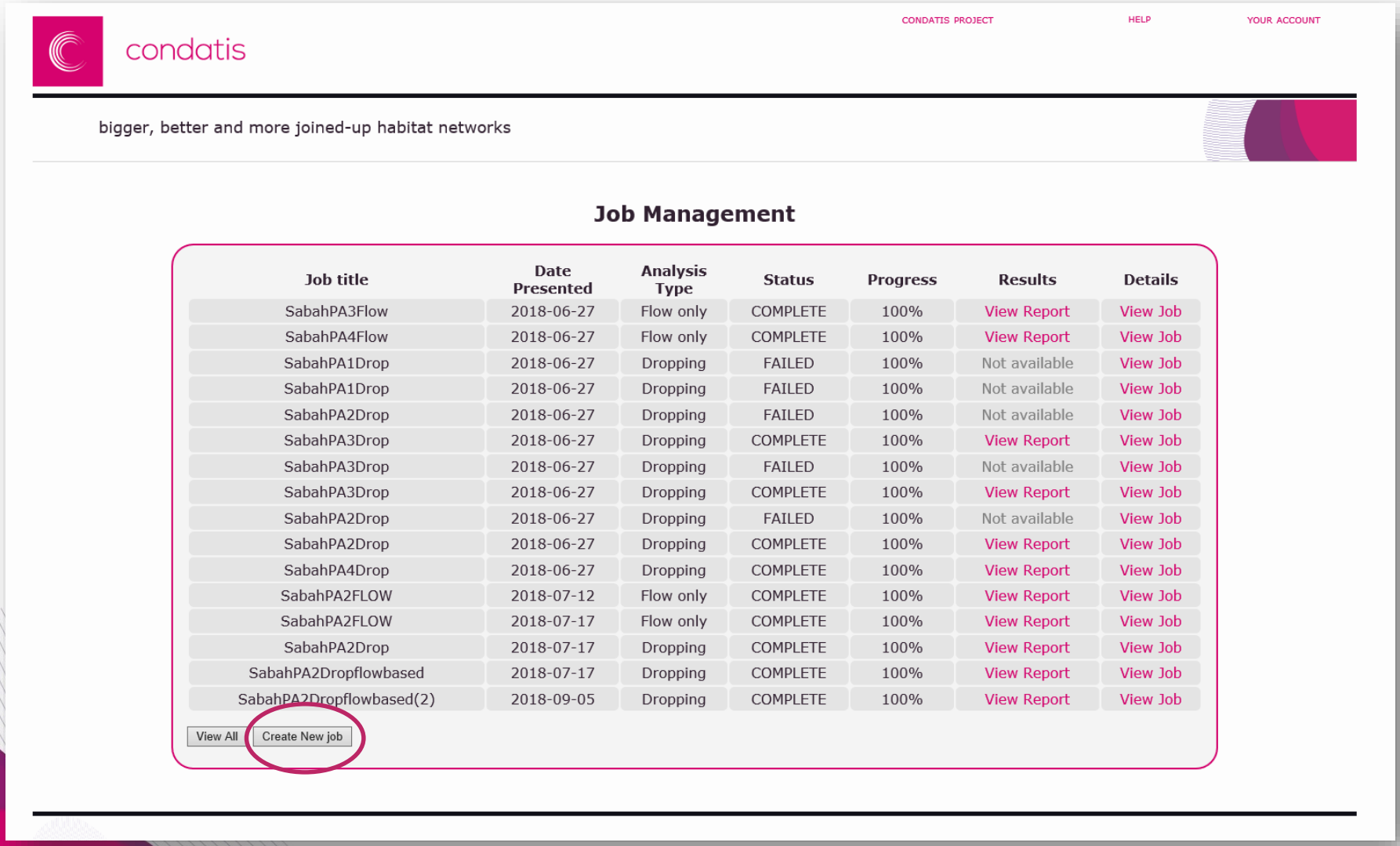
1. Open Condatis webpage & sign in



https://webapp.condatis.org.uk/

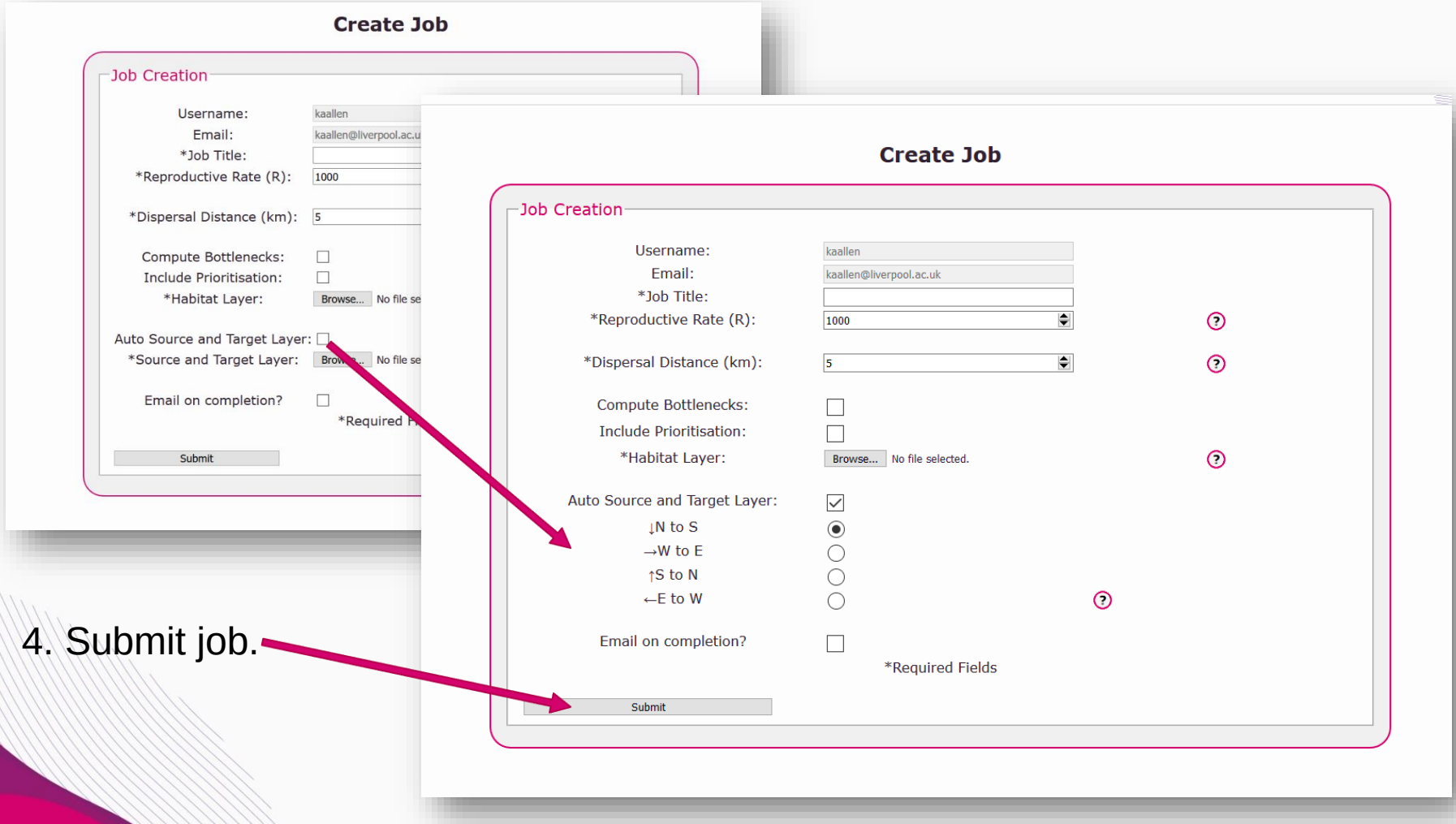
Running your analysis

2. Create New job



Running your analysis

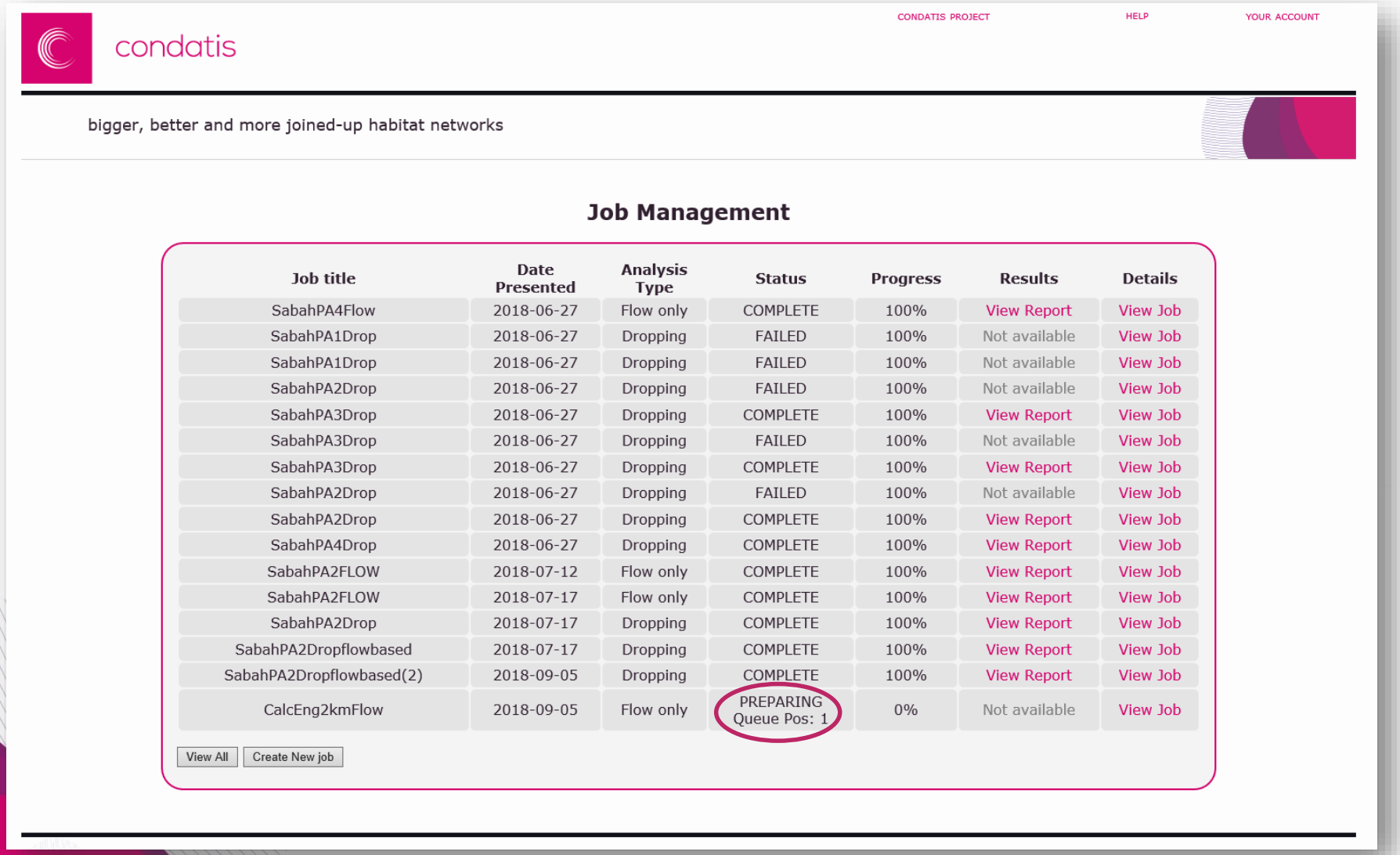
3. Set parameters and upload files.



4. Submit job.

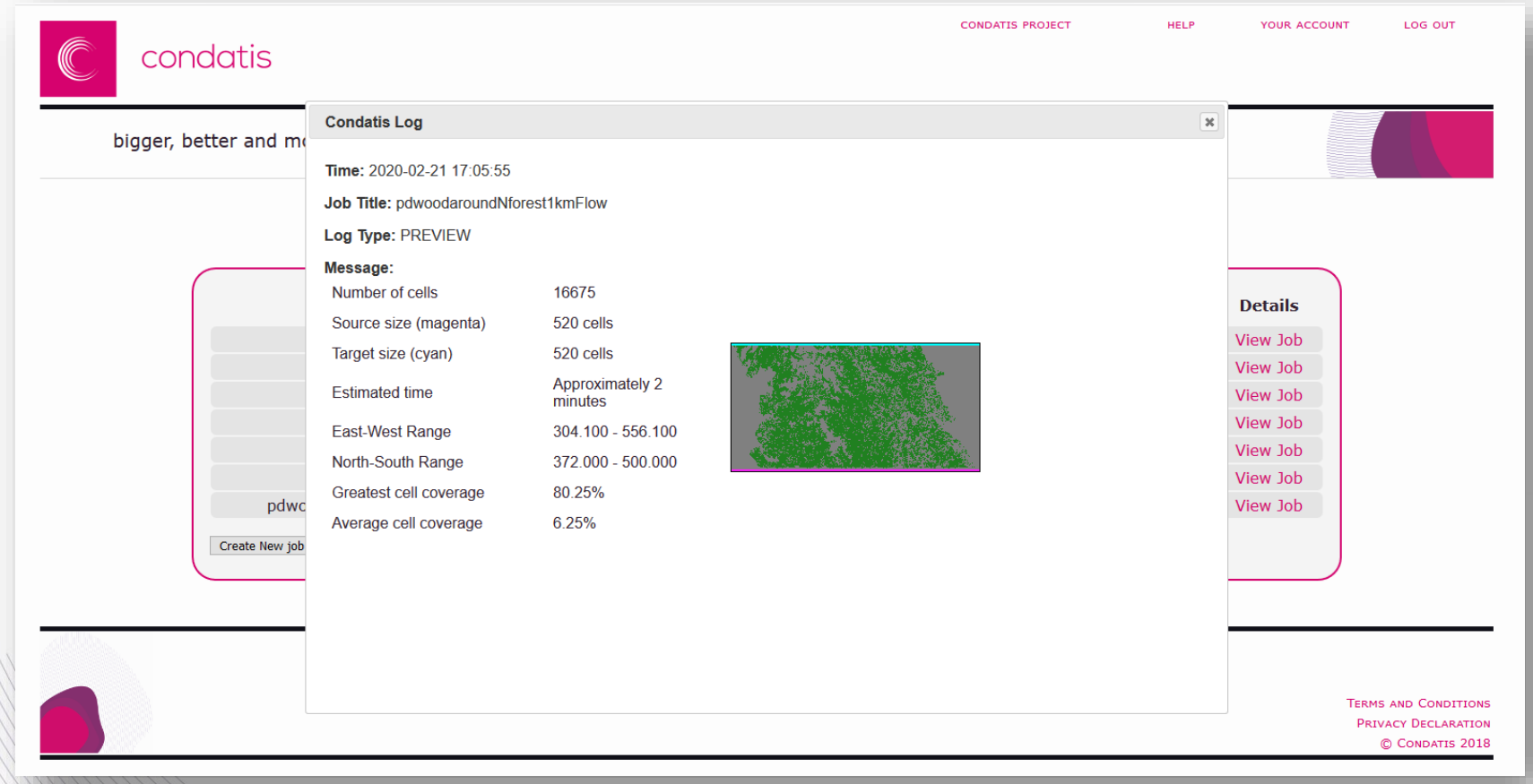
Running your analysis

5. Your position in the *Queue* will be shown



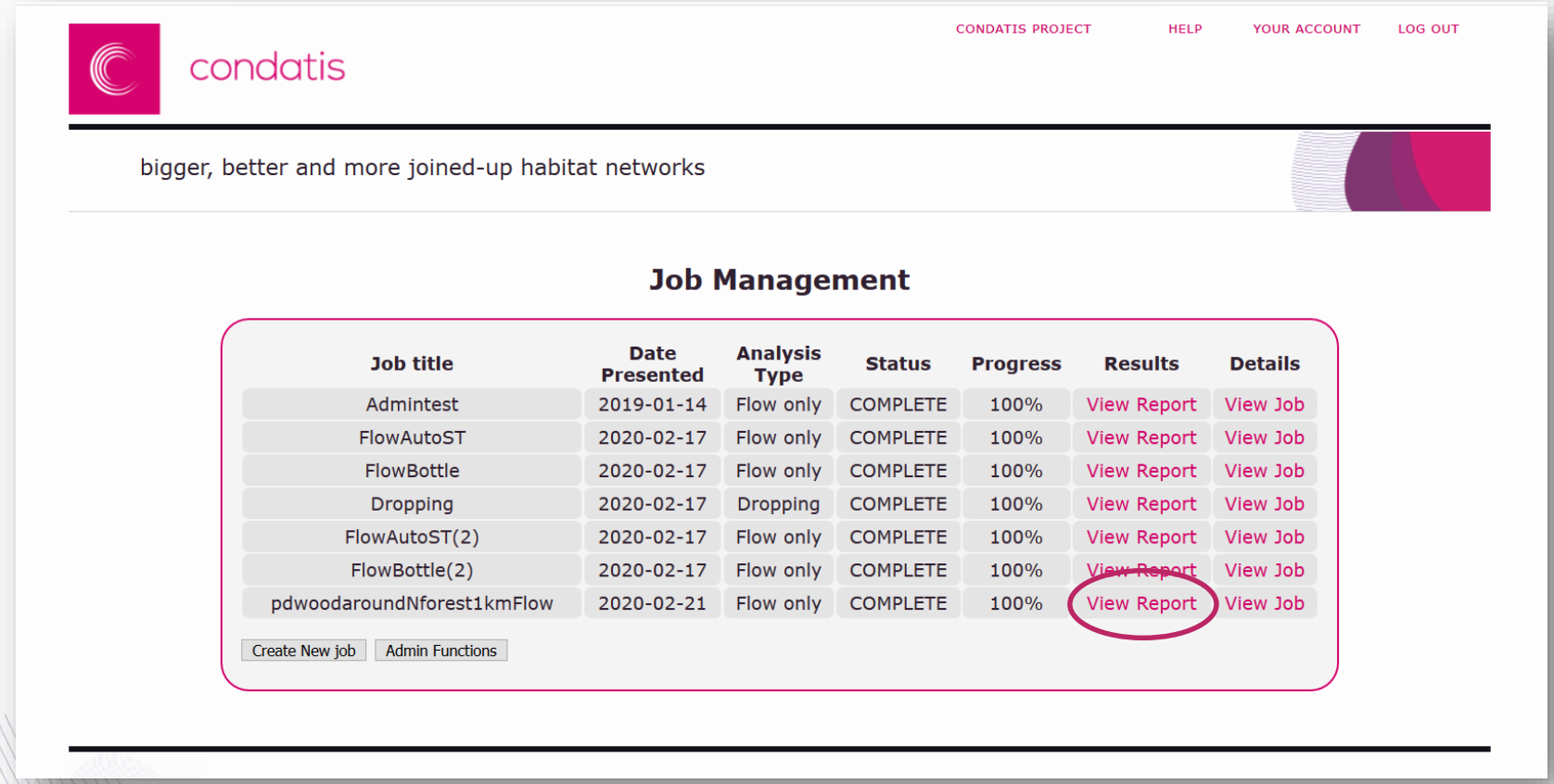
Running your analysis

5. A window will pop up, showing the key parameters of the Job; these can also be viewed by clicking on “View Job”



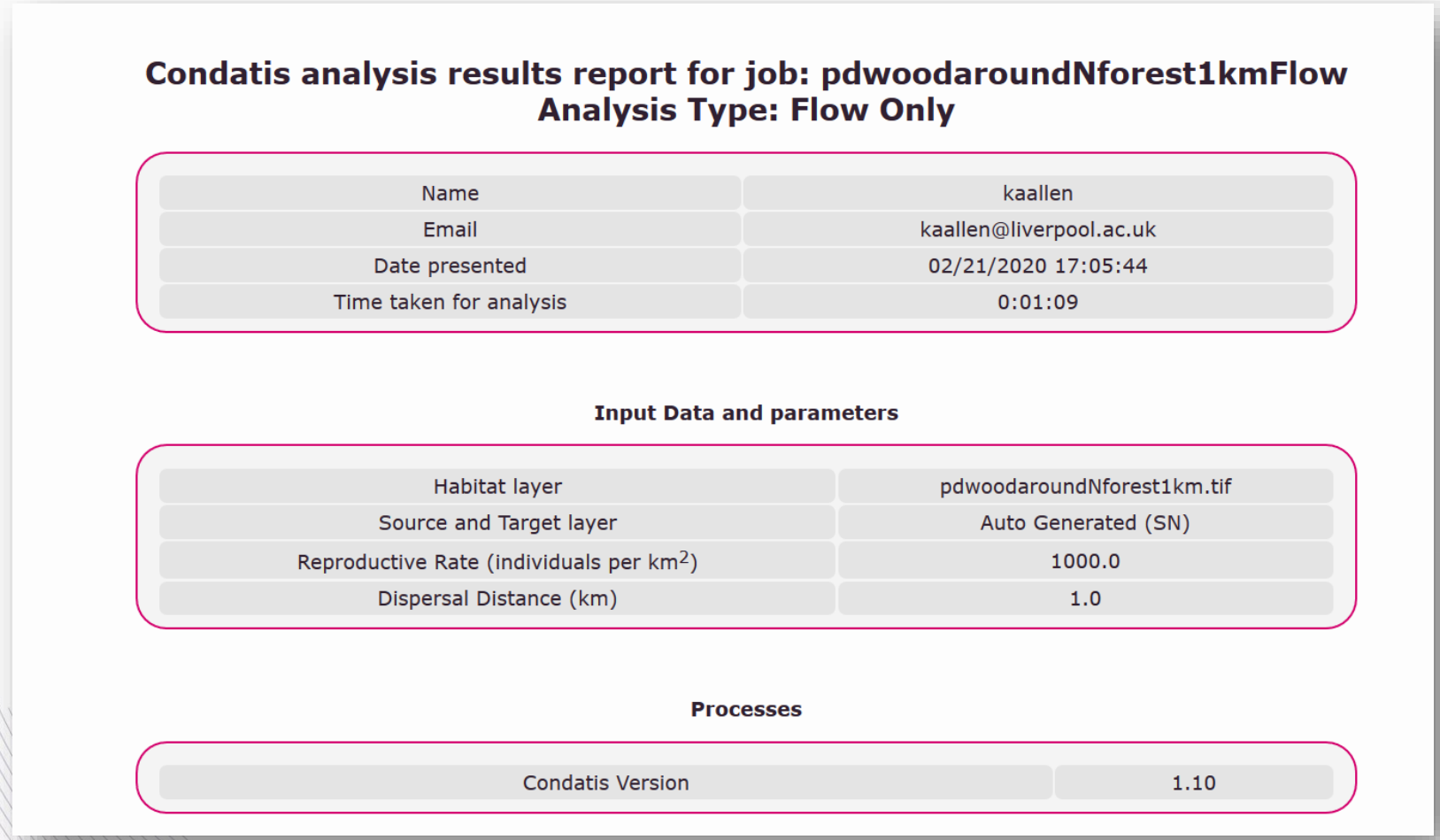
Running your analysis

6. Open Results html page



Running your analysis

6. Open Results html page



Condatis analysis results report for job: pdwoodaroundNforest1kmFlow
Analysis Type: Flow Only

Name	kaallen
Email	kaallen@liverpool.ac.uk
Date presented	02/21/2020 17:05:44
Time taken for analysis	0:01:09

Input Data and parameters

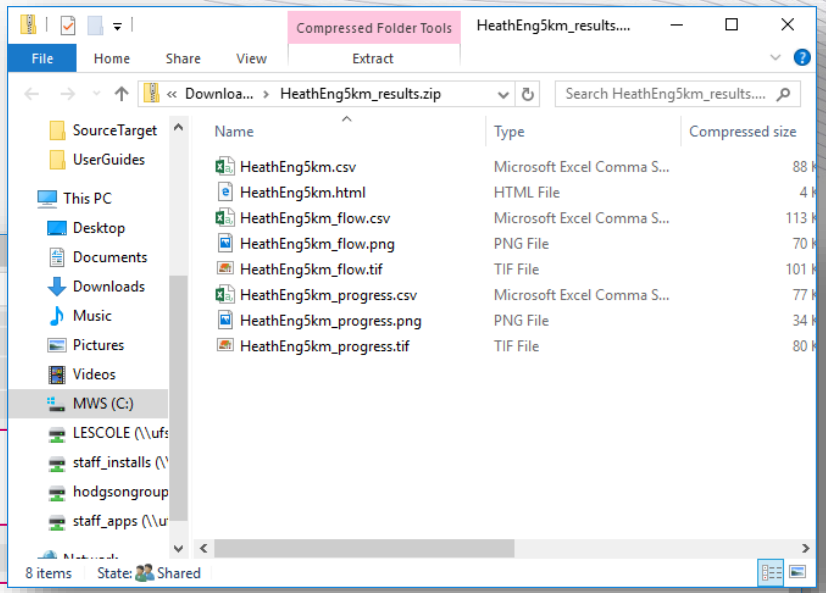
Habitat layer	pdwoodaroundNforest1km.tif
Source and Target layer	Auto Generated (SN)
Reproductive Rate (individuals per km^2)	1000.0
Dispersal Distance (km)	1.0

Processes

Condatis Version	1.10

Running your analysis

7. Download zip file



CONNECTING UP THE NORTHERN FOREST–
Flow analysis recap

Which are the main routes for woodland species moving from south to north, through the proposed Northern Forest region?

1. Open Condatis webpage & sign in
2. Create new job
3. Decide on type of analysis, i.e. Flow only
4. Fill out data input boxes
5. Check job information
6. Open Results .html page
7. Download .zip file

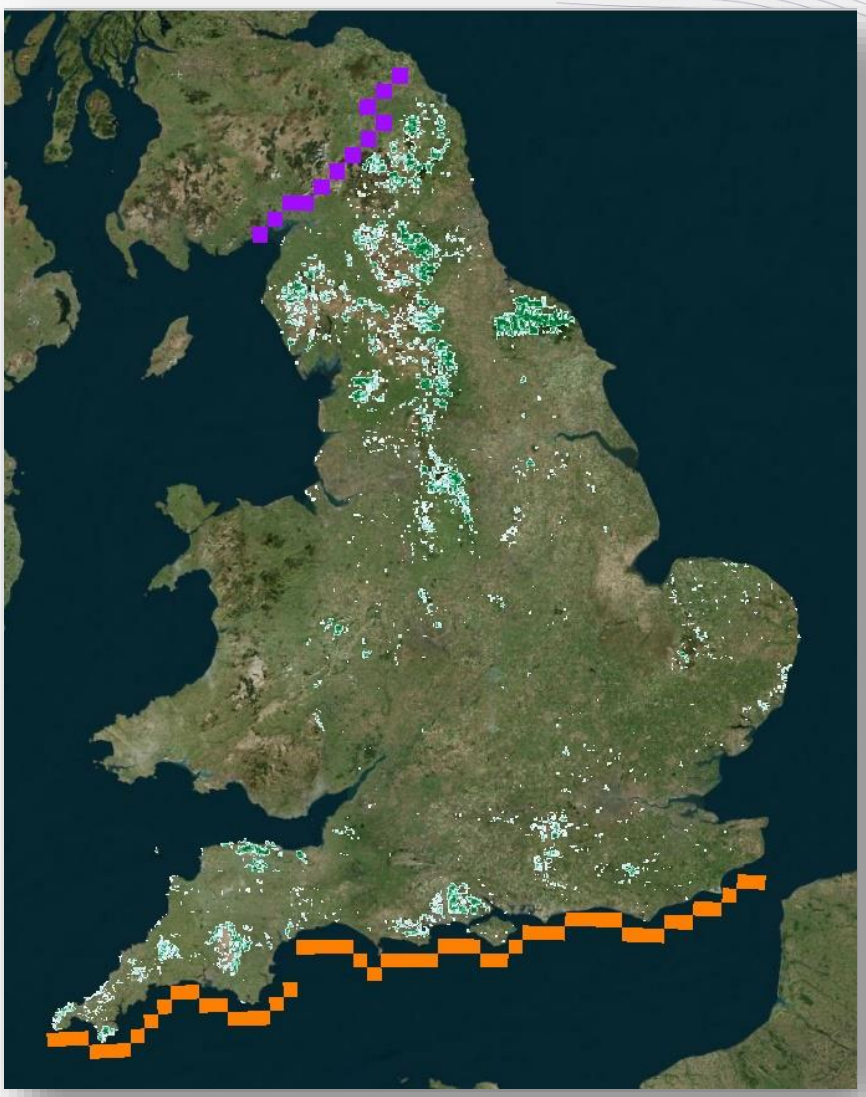
Data/files	Name
File package	**Flow1** (folder)
Habitat layer	**pdwoodaroundNforest1km.tif**
Source/target layer	**Auto south-north**
Reproductive rate	**1000 individuals per km^2**
Dispersal distance	**1km**
Bottlenecks	**No**
Condatis “job” name	*e.g. pdwoodaroundNforest1kmFlow*

FLOW 2 – Connecting up heathland in England

Conservation & Management Qs:

As the climate gets warmer, ***which routes*** *could biodiversity of heathlands take to move from the south of England to the north?*

Where are the most serious bottlenecks (chokepoints) in northward movement located, which may constitute priority areas for habitat creation?



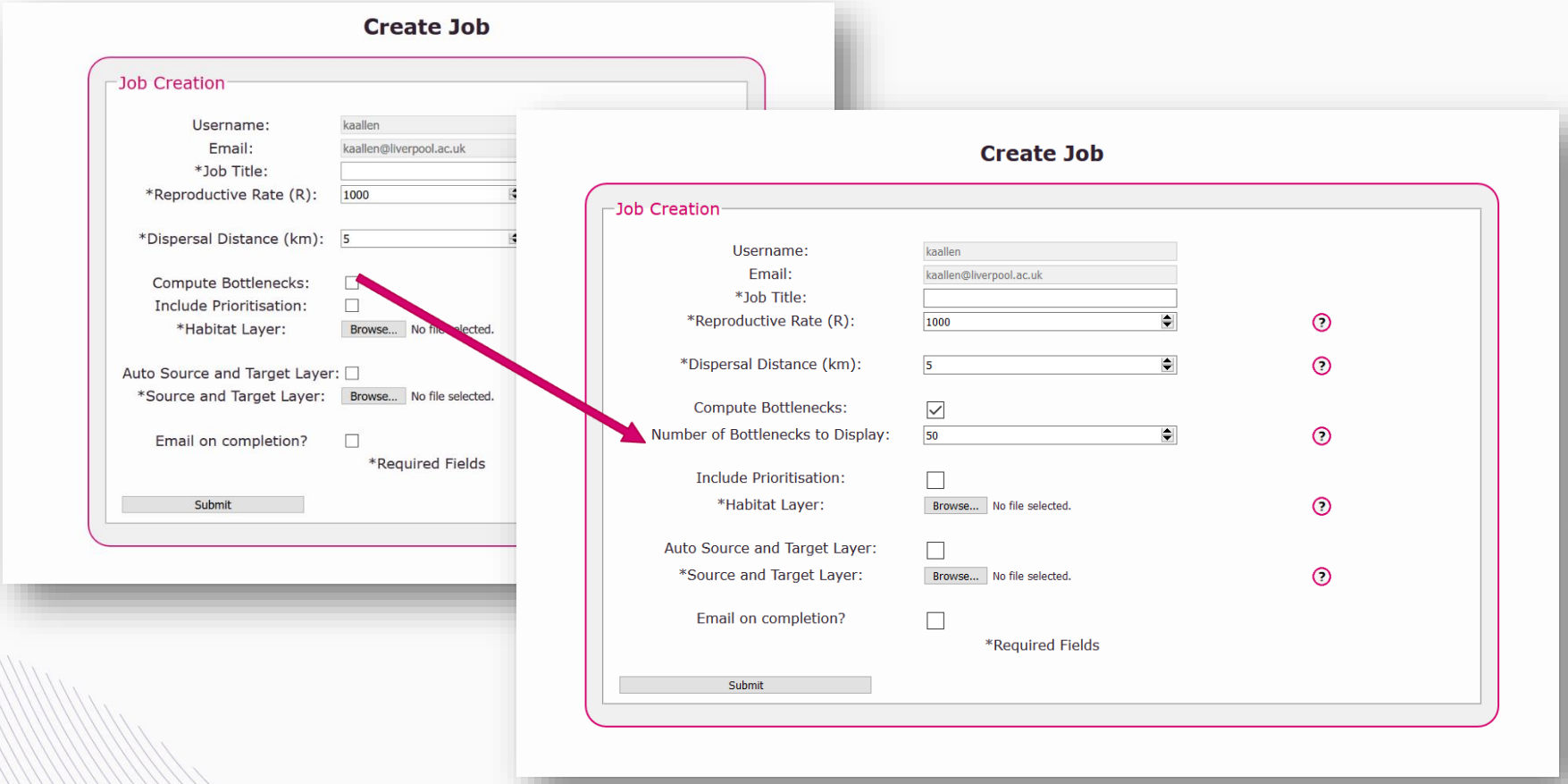
Heathland habitat across England, with *Source* and *Target* locations shown

Inputs for Condatis – FLOW 2 analysis

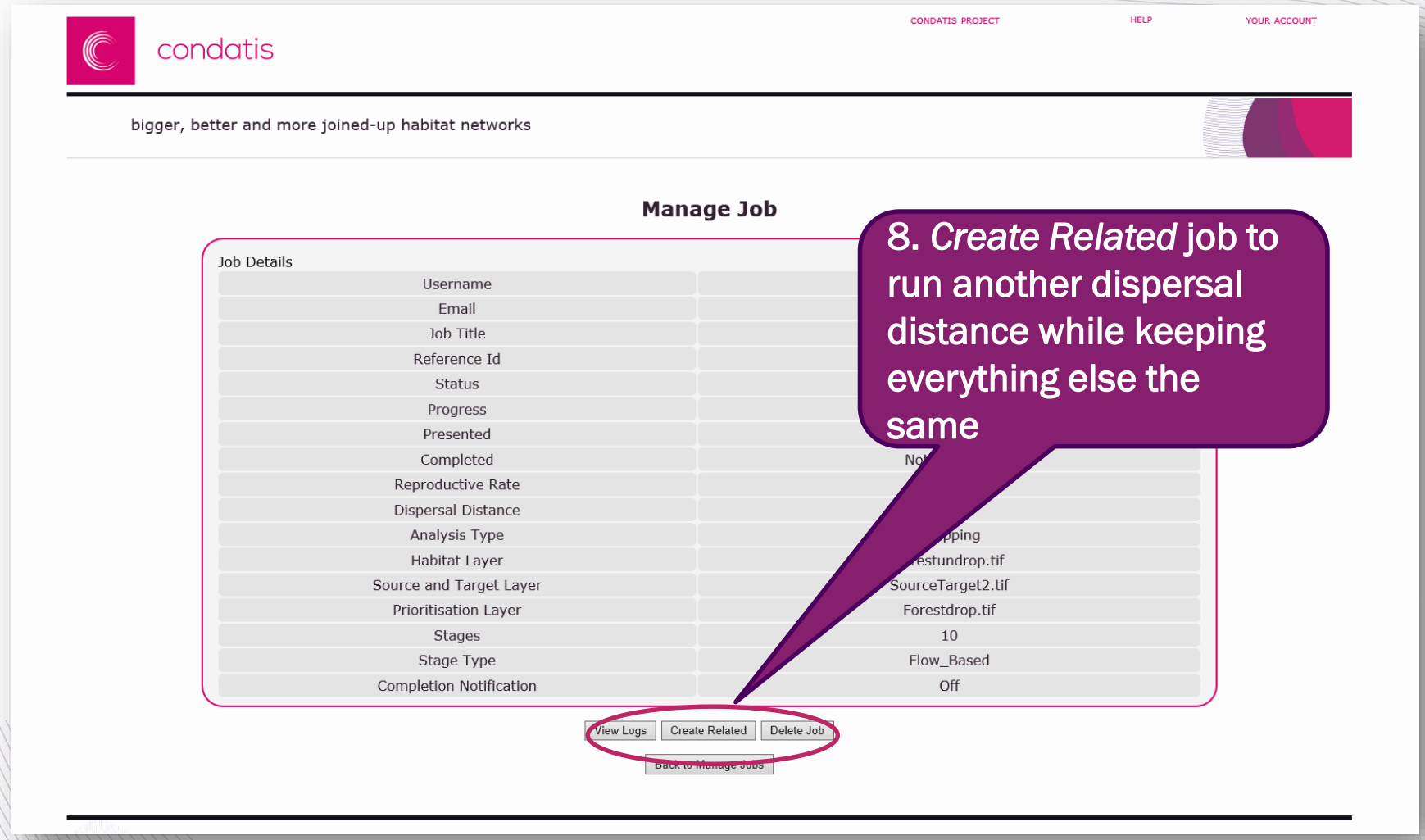
Data/files	Name
File package	**Flow2** (folder)
Habitat layer	**HeathEng1km.tif**
Source/target layer	**Eng_SN.tif**
Reproductive rate	**2000 individuals per km^2**
Dispersal distance	**5km / 10km**
Bottlenecks	**Yes**
Condatis “job” name	*e.g. HeathEng5kmFlow*

Running your analysis

1. Follow steps 2-7 above, this time uploading a source-target layer and selecting bottlenecks.



Changing dispersal



CONNECTING UP HEATHLAND IN ENGLAND – *Flow 2* analysis recap

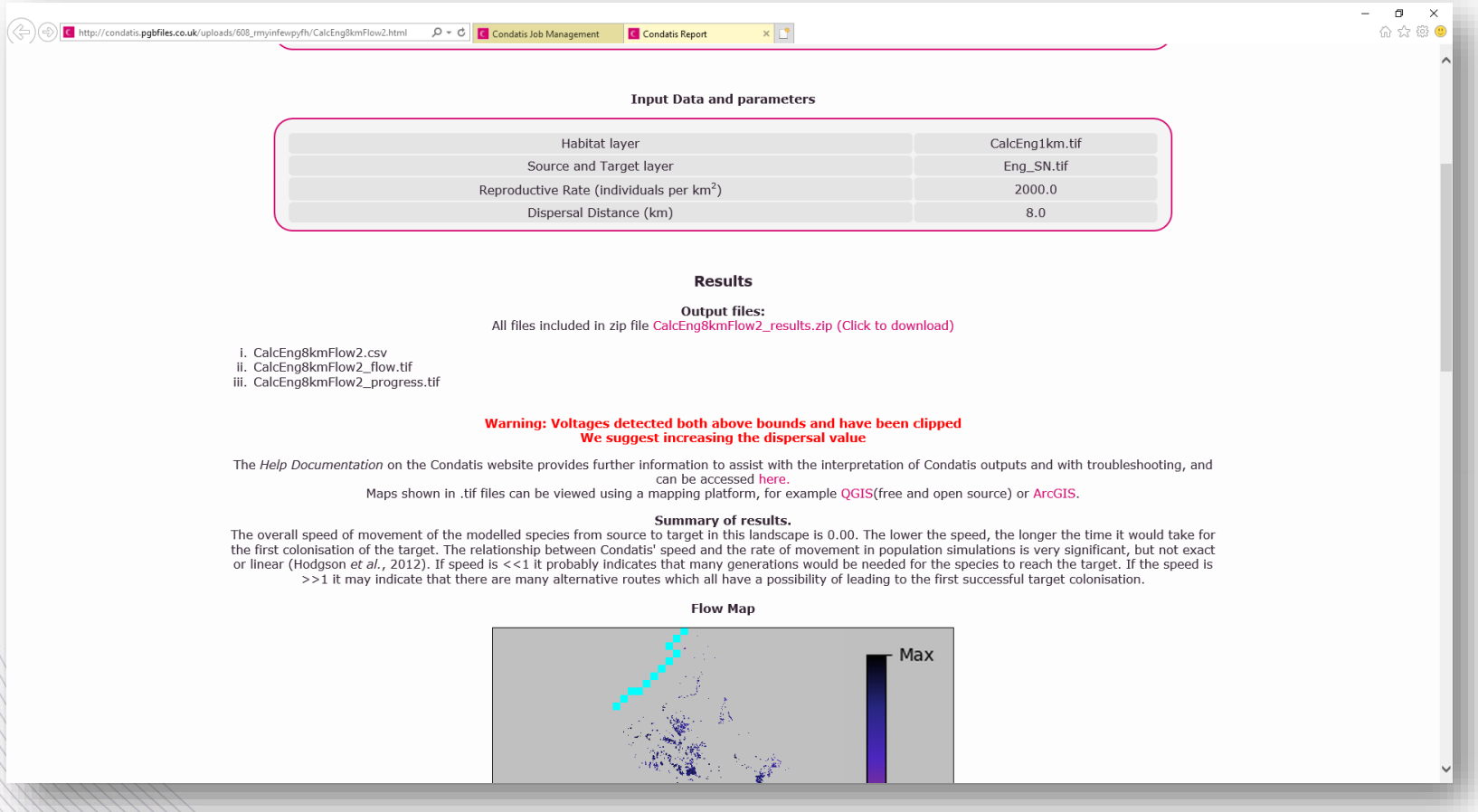
As the climate gets warmer, which routes will populations of heathlands use to move from the south of England to the north?

1. Open Condatis webpage & sign in
2. Create new job
3. Decide on type of analysis, i.e. Flow only
4. Fill out data input boxes
5. Check job information
6. Open Results html page
7. Download zip file
8. Create related job – repeat for other dispersal distance

Data/files	Name
File package	**Flow2** (folder)
Habitat layer	**HeathEng1km.tif**
Source/target layer	**Eng_SN.tif**
Reproductive rate	**2000 individuals per km^2**
Dispersal distance	**5km / 10km**
Bottlenecks	***Yes – display 50***
Condatis “job” name	*e.g. HeathEng5kmFlow*

Interpreting results – *Flow*

Just in case you get an error message…..



Interpreting results – *Flow 1*

Summary of results.

The overall speed of movement of the modelled species from source to target in this landscape is 0.2842. The lower the speed, the longer the time it would take for the first colonisation of the target. The relationship between Condatis' speed and the rate of movement in population simulations is very significant, but not exact or linear (Hodgson *et al.*, 2012). If speed is <<1 it probably indicates that many generations would be needed for the species to reach the target. If the speed is >>1 it may indicate that there are many alternative routes which all have a possibility of leading to the first successful target colonisation.

Flow Map

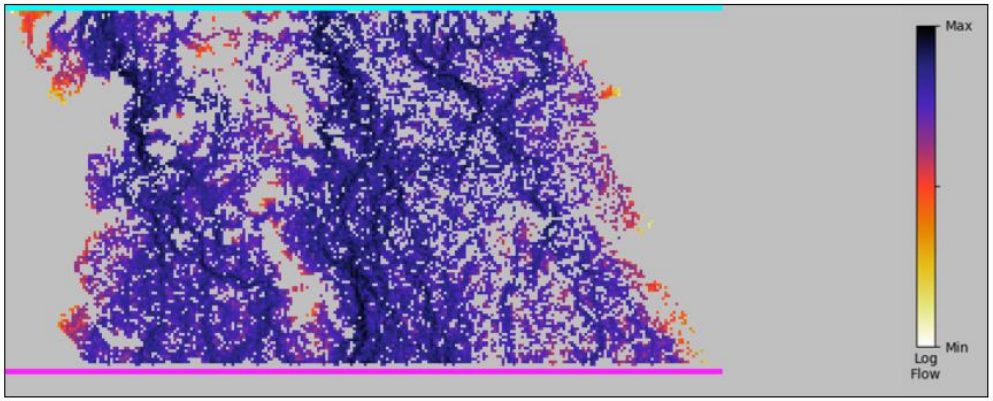


Fig. 1: The pattern of flow of individuals from source to target across the landscape. Flow through each cell is represented by the colour ramp, (note log scale). The source and target are labelled using MAGENTA and CYAN respectively. Cells that do not contain habitat are grey.

SPEED OF MOVEMENT

Which routes are the modelled population using to move through this landscape?

Are there many alternative routes or one dominant one?

Does this habitat seem relatively well connected?

Interpreting results – *Flow 1*

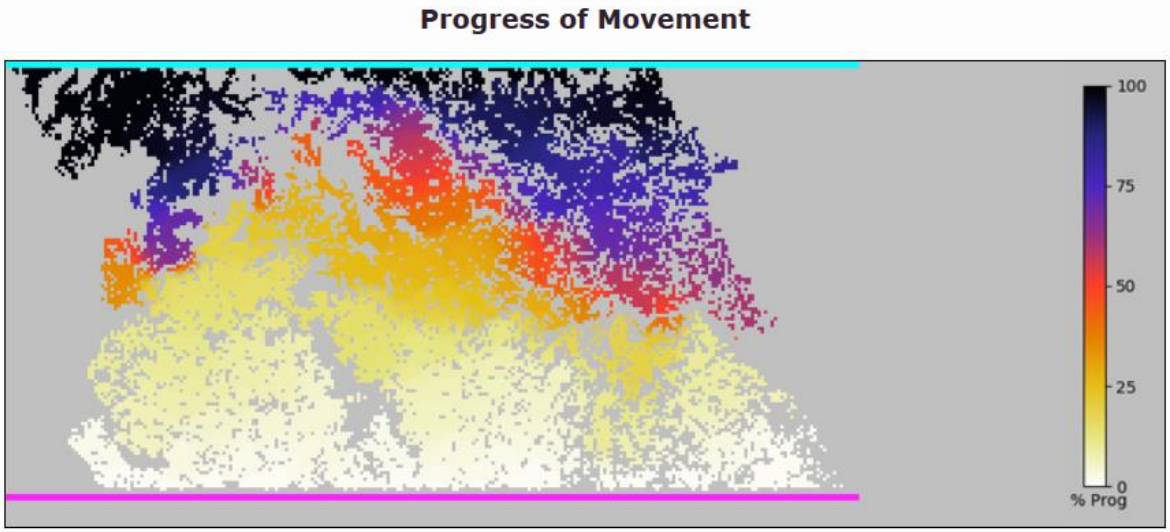


Fig. 2: The progress of movement from source to target is illustrated by the colour ramp. Bands of similar colour lie at a similar effective distance between the source and the target, e.g. a value of 50%, as demonstrated in the legend, represents the cells the species is expected to reach within half of the total 'travel' time. The source and target are labelled using MAGENTA and CYAN respectively.

PROGRESS OF MOVEMENT

Are there regions of "slow progress" in the landscape or is speed of movement relatively uniform across it?

Interpreting results – *Flow 2*

Summary of results.

The overall speed of movement of the modelled species from source to target in this landscape is 6.056567e-06. The lower the speed, the longer the time it would take for the first colonisation of the target. The relationship between Condatis' speed and the rate of movement in population simulations is very significant, but not exact or linear (Hodgson *et al.*, 2012). If speed is <<1 it probably indicates that many generations would be needed for the species to reach the target. If the speed is >>1 it may indicate that there are many alternative routes which all have a possibility of leading to the first successful target colonisation.

Flow Map

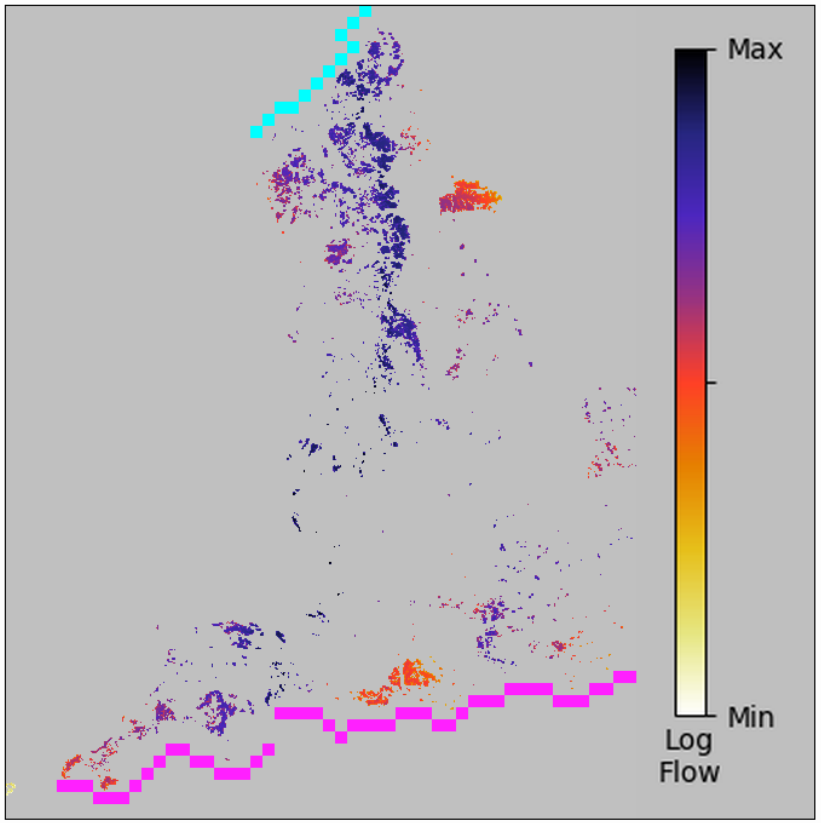


Fig. 1: The pattern of flow of individuals from source to target across the landscape. Flow through each cell is represented by the colour ramp, (note log scale). The source and target are labelled using MAGENTA and CYAN respectively. Cells that do not contain habitat are grey.

Dispersal distance = 5km

SPEED OF MOVEMENT

Which routes are the modelled population using to move through this landscape?

How quickly is the species of interest moving between the southern source and northern target?

Interpreting results – *Flow 2*

Summary of results.

The overall speed of movement of the modelled species from source to target in this landscape is 0.0027. The lower the speed, the longer the time it would take for the first colonisation of the target. The relationship between Condatis' speed and the rate of movement in population simulations is very significant, but not exact or linear (Hodgson *et al.*, 2012). If speed is <<1 it probably indicates that many generations would be needed for the species to reach the target. If the speed is >>1 it may indicate that there are many alternative routes which all have a possibility of leading to the first successful target colonisation.

Dispersal distance = 10km

SPEED OF MOVEMENT

Which routes are the modelled population using to move through this landscape?

How quickly is the species of interest moving between the southern source and northern target?

Flow Map

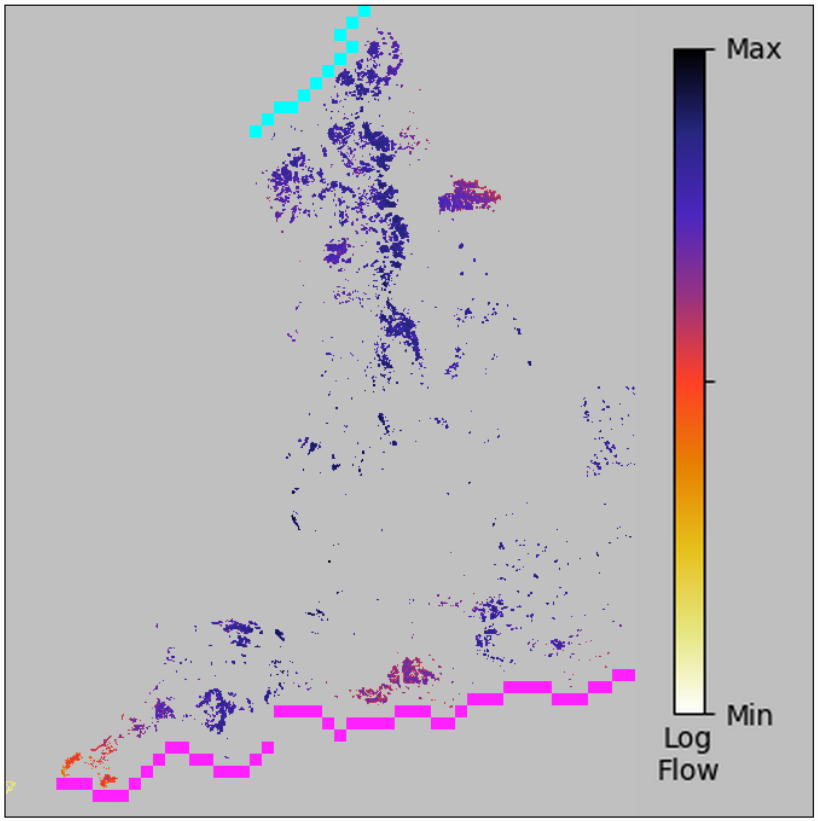
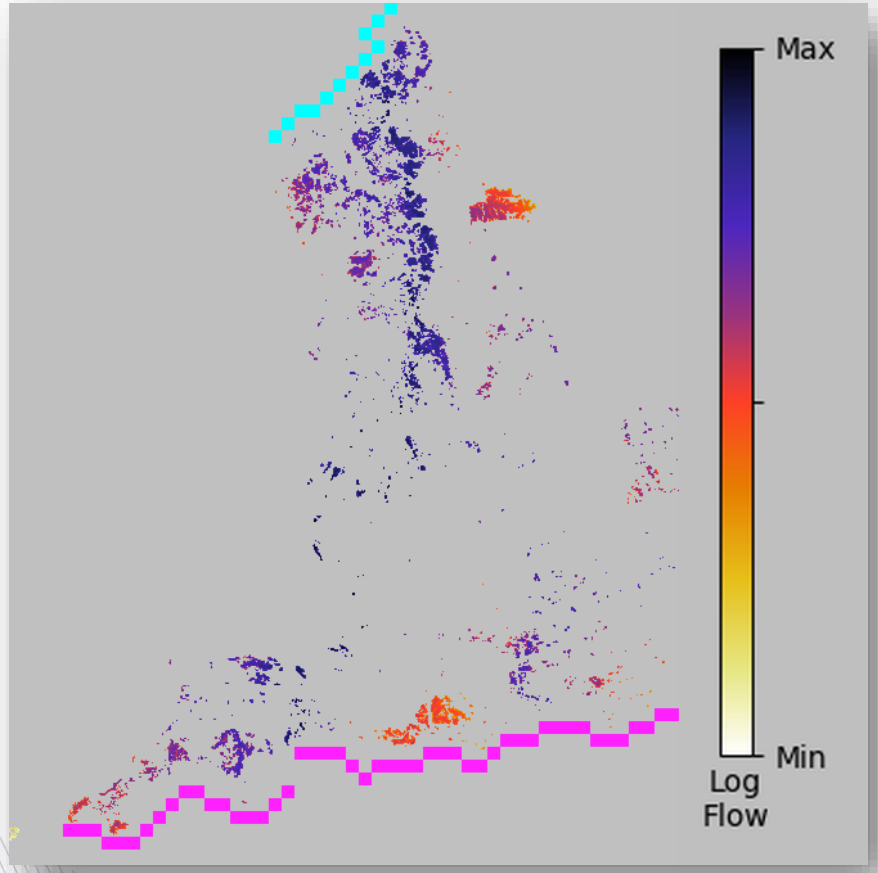
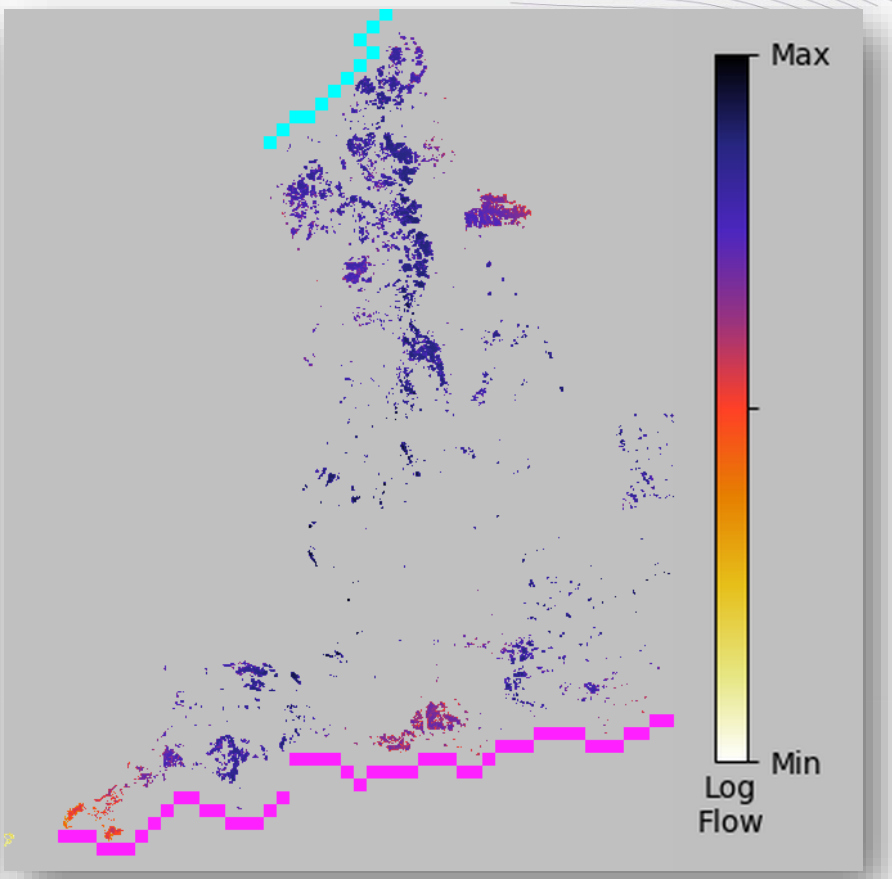


Fig. 1: The pattern of flow of individuals from source to target across the landscape. Flow through each cell is represented by the colour ramp, (note log scale). The source and target are labelled using MAGENTA and CYAN respectively. Cells that do not contain habitat are grey.

Interpreting results – *Flow 2*



Dispersal distance = 5km



Dispersal distance = 10km

FLOW

Are there differences in the flow of populations across this landscape? Why?

Interpreting results – *Flow 2*

Bottlenecks (5km dispersal)

Where are the chokepoints in northward movement, which may constitute priority areas for habitat creation?

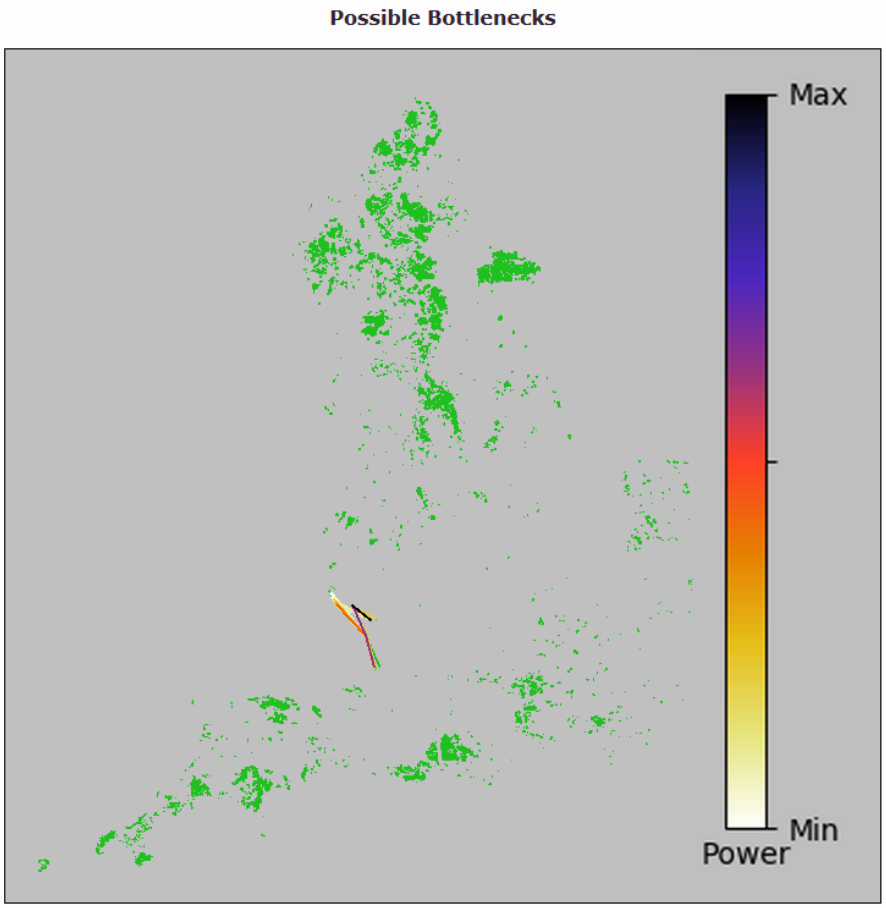
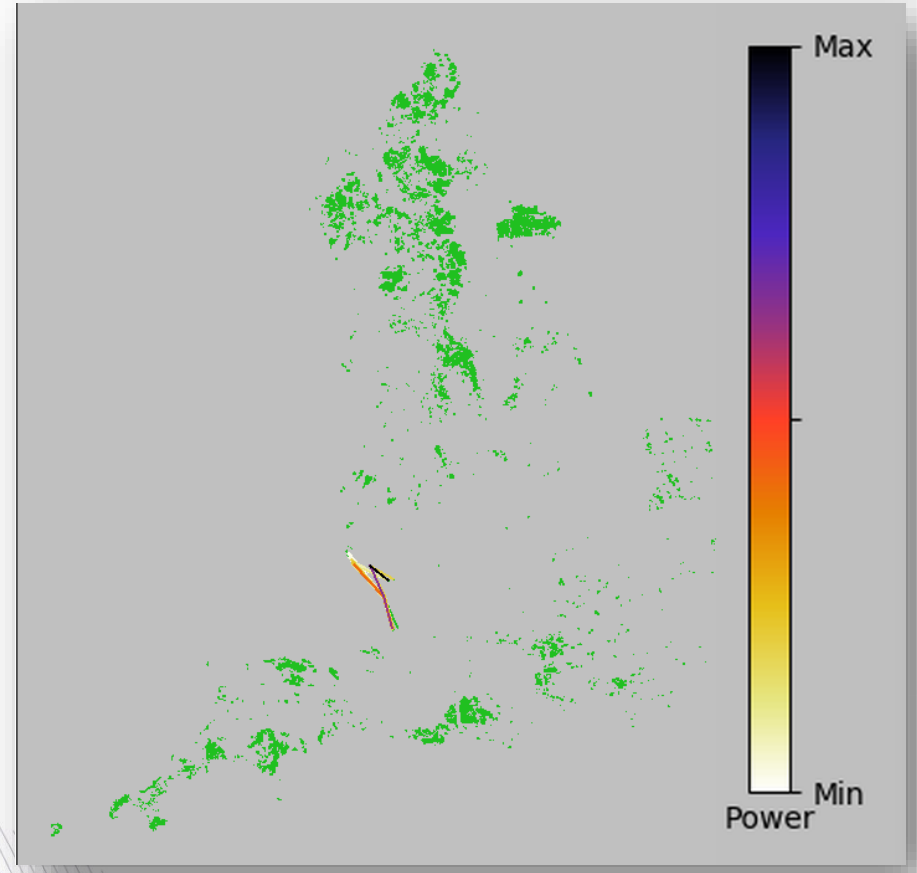
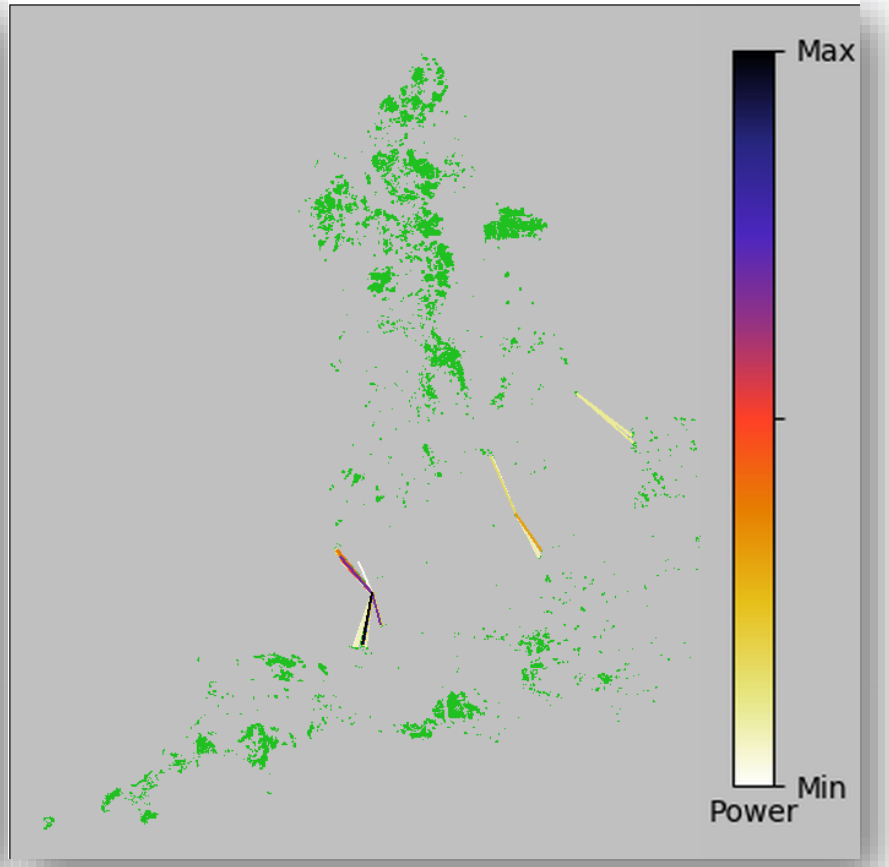


Fig. 3: Shows the links with the highest power. Power can be thought of as the "strain" placed on that link relative to the rest of the circuit. This plot shows the top 50 links as requested. Consult **HeathEng5km_bottlenecks.csv** or view the shapefile **HeathEng5km_bottlenecks.shp** for actual power values. The habitat layer is in green for reference.

Interpreting results – *Flow 2*



Dispersal distance = 5km



Dispersal distance = 10km

Bottlenecks

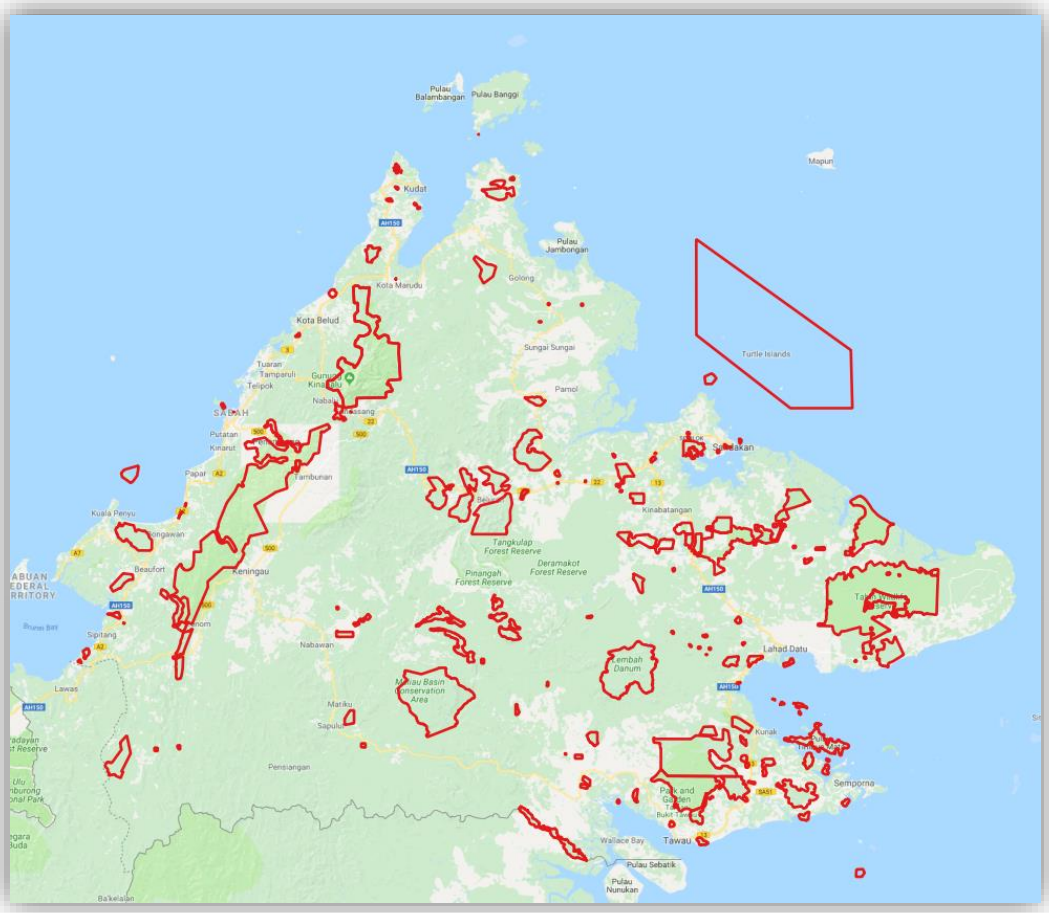
Are there differences in the bottlenecks across this landscape with different dispersal distances? Why?

Prioritisation - Enhancing Sabah's PA Network

Conservation & Management Qs:

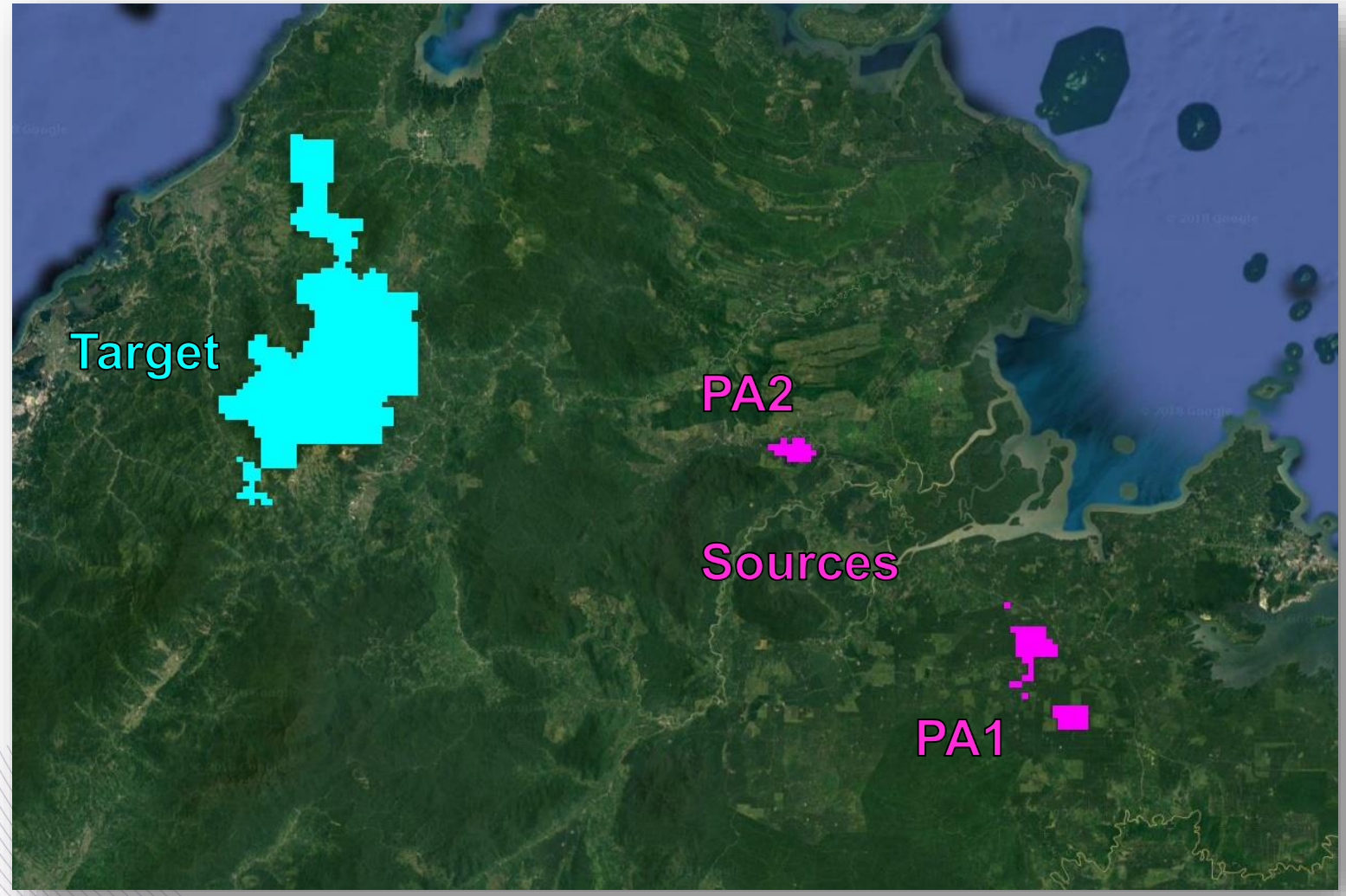
*As the climate gets hotter, **which forested routes** will populations take to move from lowland Protected Areas to suitable habitats on Mount Kinabalu?*

*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?*



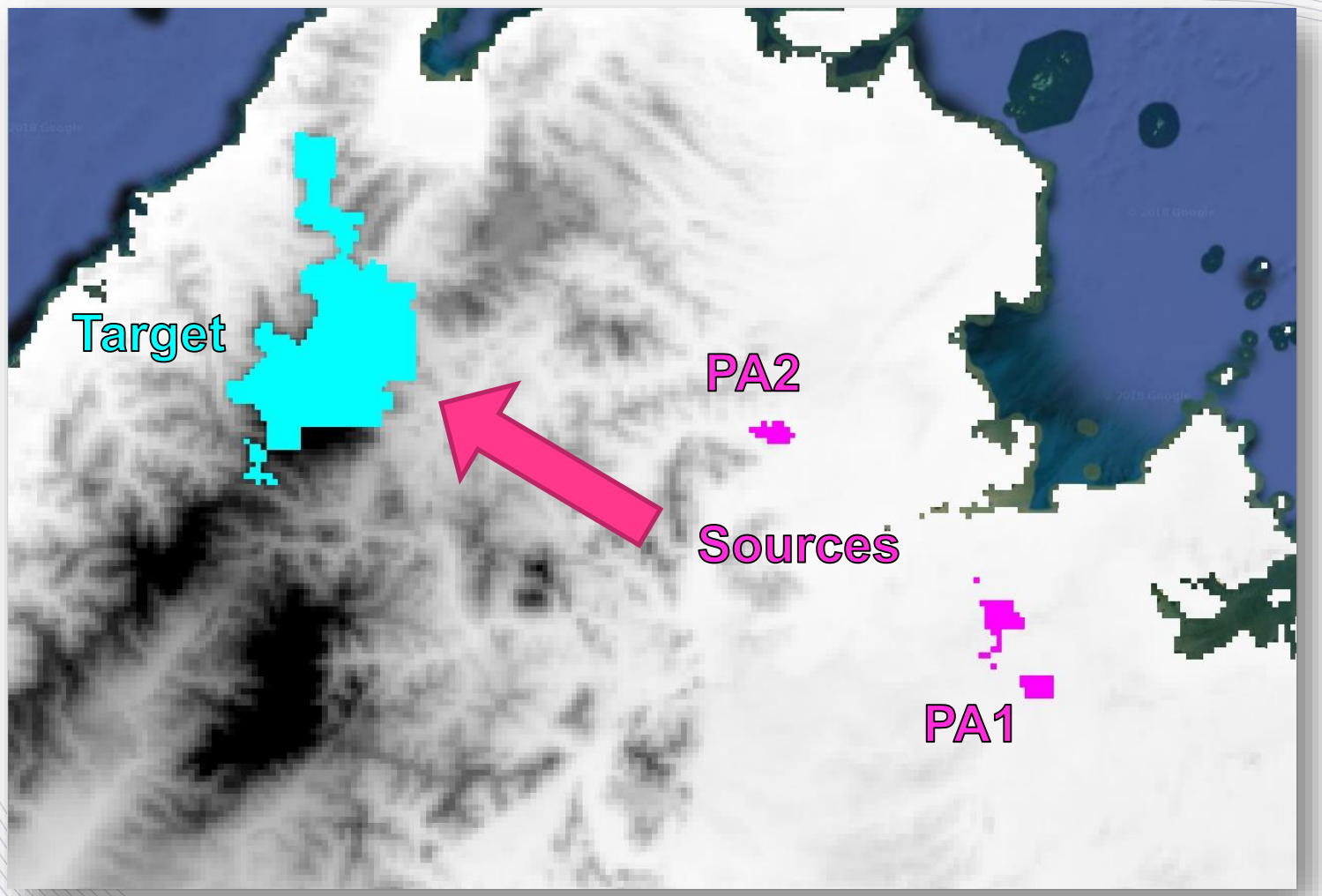
Sabah's Protected Areas

Case study Protected Areas



Lowland *sources* to highland *target*

....Direction of movement



Annual mean temperature

Species' ranges will shift towards cooler areas

....Habitat – mostly unprotected

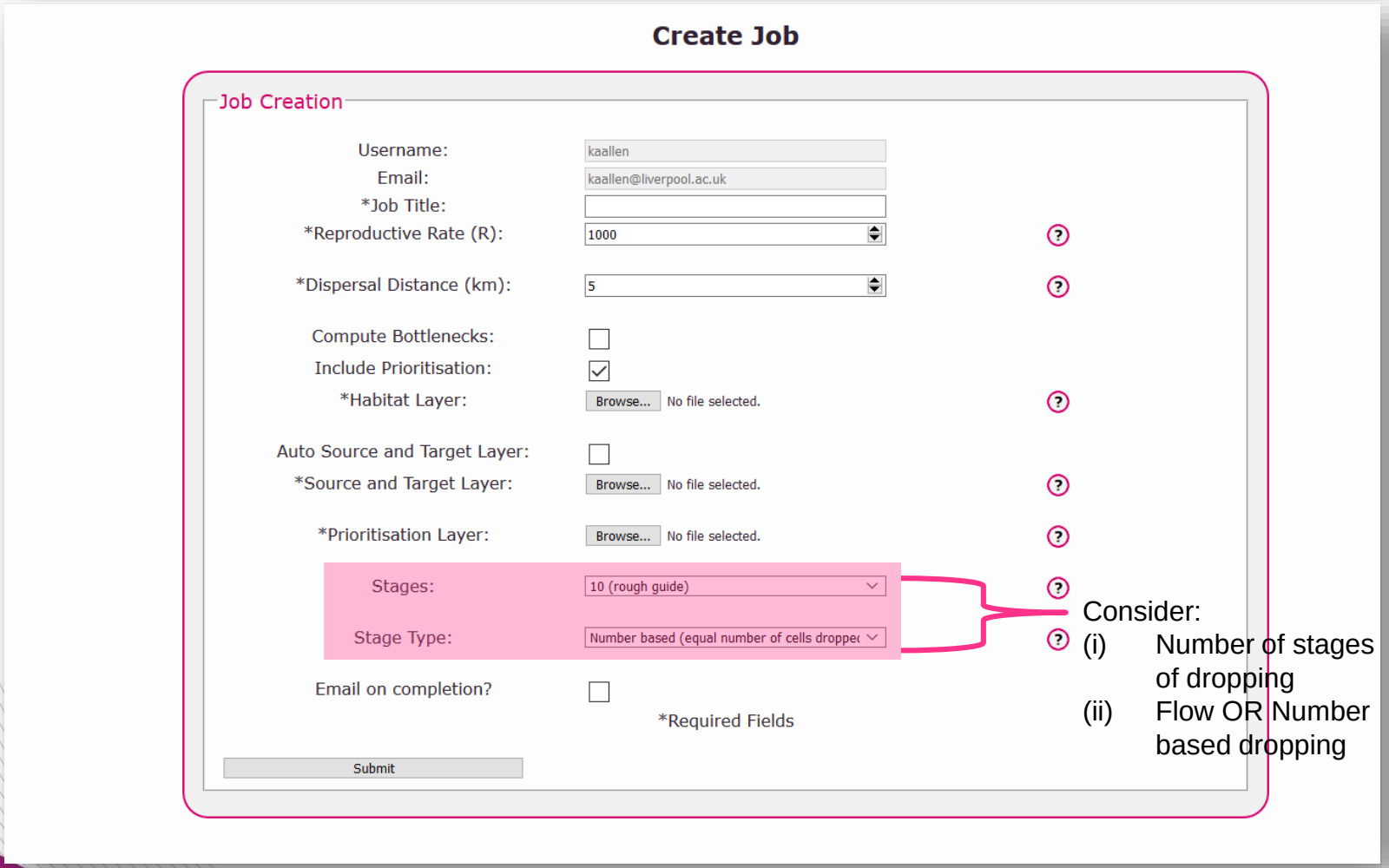
Forest cover (Gaveau *et al.*, 2016)
Species will move through forest habitat

Inputs for Condatis – *Prioritisation* analysis

Data/files	Name
File package	**Prioritisation** (folder)
Source/target layer	**SourceTarget1.tif or SourceTarget2.tif**
Habitat layer	**Forestundrop.tif**
Prioritisation layer	**Forestdrop.tif**
Reproductive rate	**2000 individuals per km^2**
Dispersal distance	**4km**
Bottlenecks	**No**
Number of stages for dropping	**10 (rough guide)**
Dropping stage Type	**Number based**
Condatis “job” name	**e.g. SabahPA1Prioritise**

Prioritisation analysis

Fill out data input boxes & run analysis



Prioritisation analysis

Open Results html page & download zip files

Condatis analysis results report.
Job: SabahPA2Drop
Analysis Type: Dropping

Name	kaallen
Email	kaallen@liverpool.ac.uk
Date presented	02/21/2020 18:29:20
Time taken for analysis	0:03:25

Input Data and parameters

Habitat layer	Forestundrop.tif
Source and Target layer	SourceTarget2.tif
Prioritisation Layer	Forestdrop.tif
Reproductive Rate (individuals per km^2)	2000.0
Dispersal Distance (km)	4.0

Processes

Condatis Version	1.10
Dropping Steps	10
Step type	Cell_Number

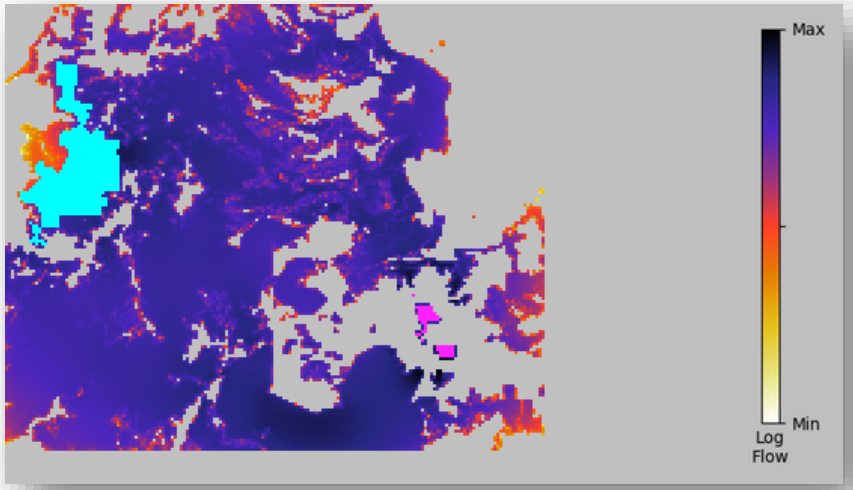
Results

Output files:
All files included in zip file SabahPA2Drop_results.zip (Click to download)
The zip file includes:

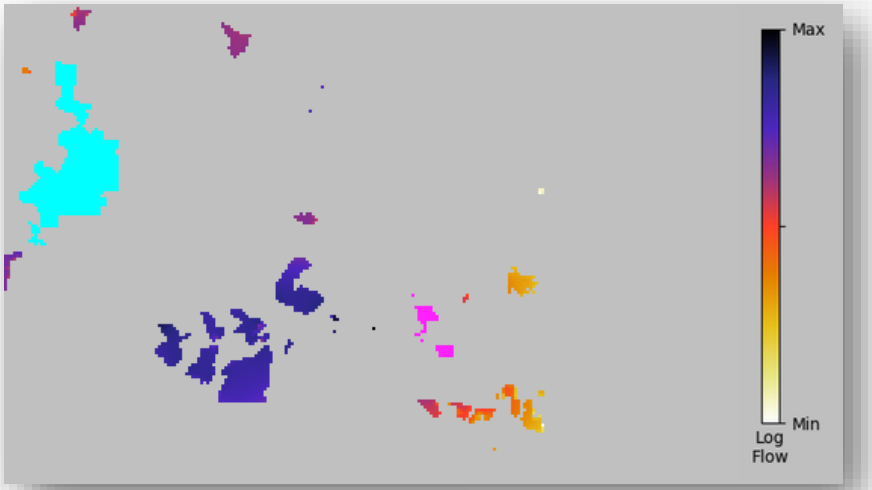
Prioritisation analysis

11. Check “job” has worked by viewing html report

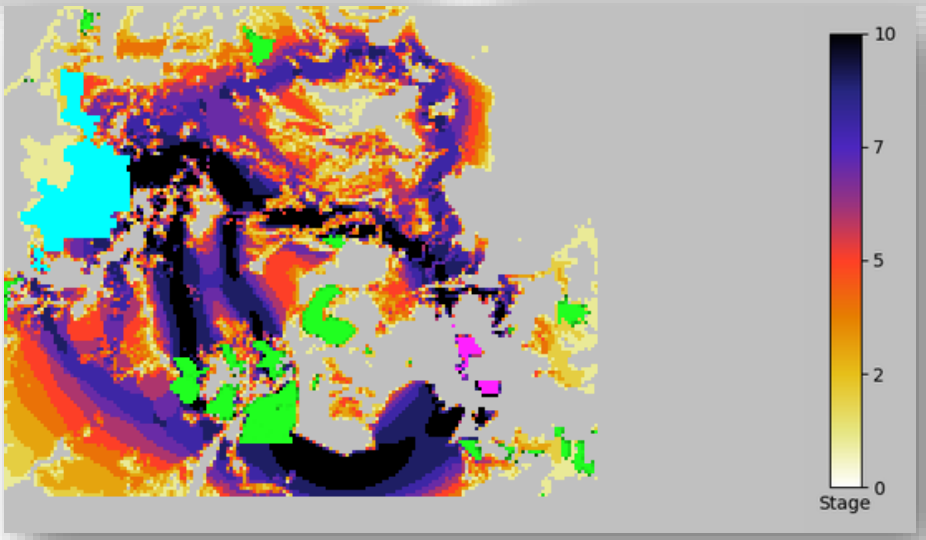
PA1



Start flow



End flow



Dropping rank

SABAH PROTECTED AREAS – *Prioritisation* analysis recap

Which currently unprotected forest habitats that are a priority for long-term connectivity between lowland PAs and Mount Kinabalu?

1. Open Condatis webpage & sign in
2. Create new job
3. Decide on type of analysis, i.e. *Include prioritisation*
4. Fill out data input boxes
5. Check job information
6. Open Results html page
7. Download zip file
8. Create related job – repeat for other source PA

Data/files	Name
File package	**Prioritisation** (folder)
Source/target layer	**SourceTarget1.tif or SourceTarget2.tif**
Habitat layer	**Forestundrop.tif**
Prioritisation layer	**Forestdrop.tif**
Reproductive rate	**2000 individuals per km^2**
Dispersal distance	**4km**
Bottlenecks	**No**
Number of stages for dropping	**10 (rough guide)**
Dropping stage Type	**Number based**
Condatis “job” name	**e.g. SabahPA1Prioritise**

Interpreting results – *Prioritisation*

Summary of results.

For this landscape of interest, the speed of movement of the modelled species changes from 444.7793 before any habitat is dropped to 0.0000 once all 15569 additional habitat cells are lost. This represents a reduction in speed of 100.0000% with a loss of habitat of 15569 km^2 (93.52% of the total habitat area).

Trajectory of dropping

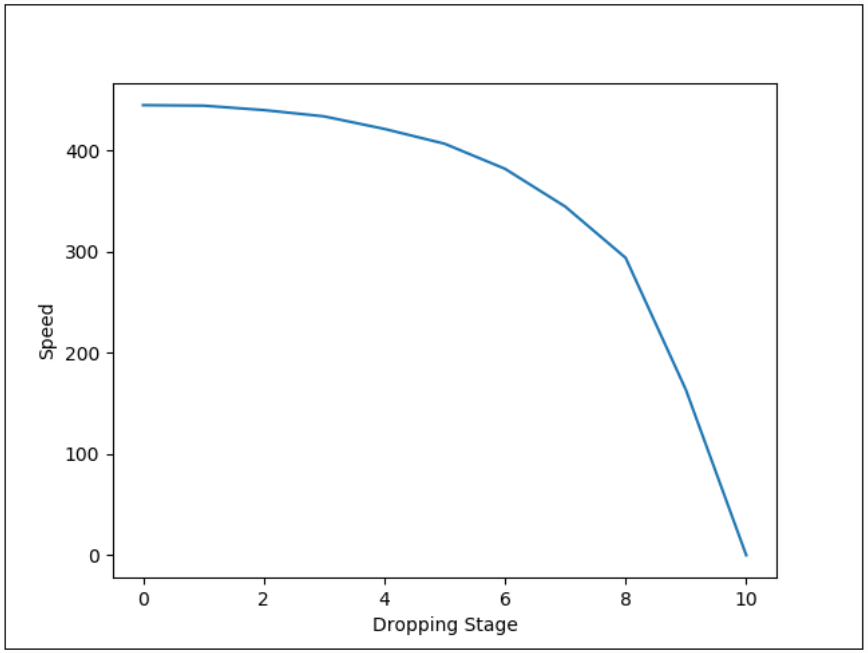


Fig. 1: The speed, (inversely related to the time taken to cross from source to target), is plotted against the stage of dropping. Here the dropping mode is **Number based**. (The dropping of habitat cells from the Prioritisation layer is performed such that an equal amount of cells are dropped per stage). Speed is expected to get slower when habitat is lost from the landscape, but notice how severely speed is lost at different stages.

What impact does loss of habitat, i.e. dropping, have on speed of movement?

How does speed change with each stage of dropping?

Interpreting results – *Prioritisation*

Which cells, when lost, cause the greatest reduction in speed?

BACKGROUND RESULTS

Additional figures that enable further interrogation of wildlife movement in the landscape.

Loss of Speed

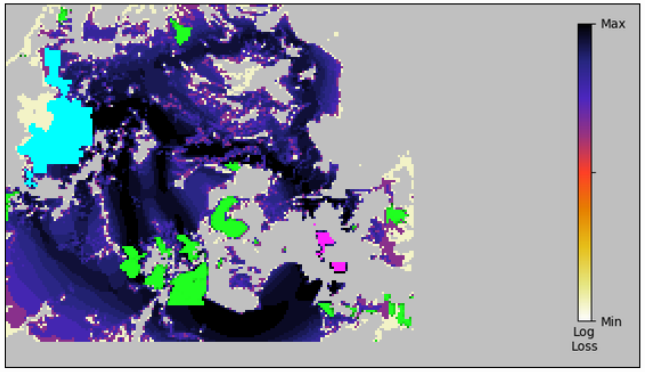


Fig. 3: The reduction in the speed of movement of the species from source to target with each stage of dropping is illustrated by the colour ramp, (note log scale). The source and target are labelled using MAGENTA and CYAN respectively. Non-droppable habitat cells are coloured GREEN. This is a spatial representation of the values in column 5 of Table 1, Reduction per cell. Higher values mean that the loss of these cells was highly detrimental to the total speed achievable in the landscape, and it implies these cells are of higher priority for connectivity.

Step Dropping Summary

Stage	Dropped	Speed	Speed Reduction	Reduction per Cell
Initial	0	444.779268	0.000000	0.000000
1	1557	444.283717	0.495551	0.000318
2	1557	439.916432	4.367285	0.002805
3	1557	433.701748	6.214684	0.003991
4	1557	421.301069	12.400679	0.007964
5	1557	406.642873	14.658197	0.009414
6	1557	381.891774	24.751098	0.015897
7	1557	344.490884	37.400891	0.024021
8	1557	293.879650	50.611234	0.032506
9	1557	163.357971	130.521679	0.083829
Final	1556	1.162501e-05	1.633580e+02	

Table 1: Summary of results from Condatis dropping analysis, showing the effect of dropping cells at each stage.

Interpreting results – *Prioritisation*

Which are the most important additional habitat cells to conserve?

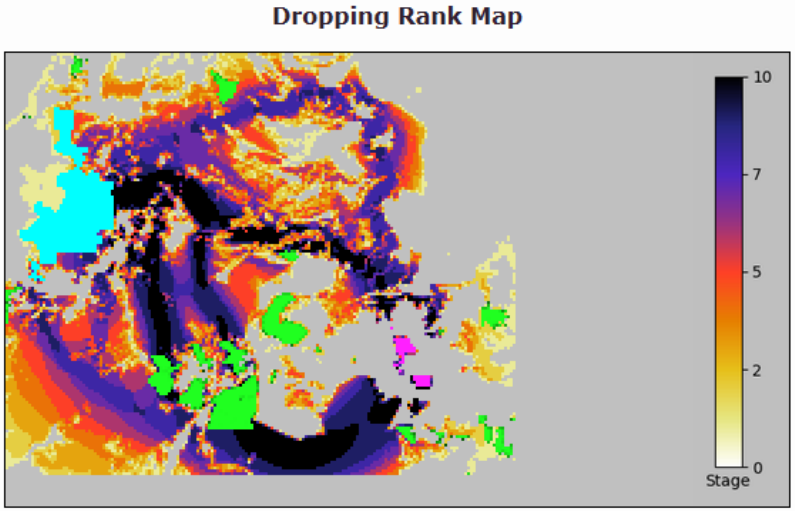
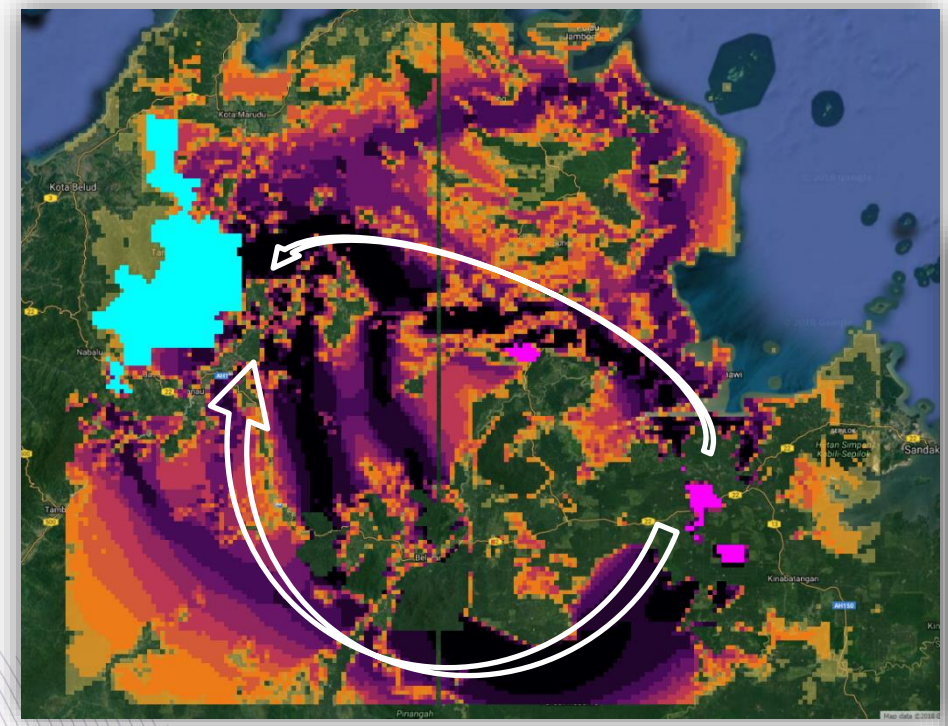


Fig. 2: An illustration of the rank of each habitat cell in the dropping analysis, with each drop stage represented by a different colour on the ramp. The source and target are labelled using MAGENTA and CYAN respectively. Non-droppable habitat cells are coloured GREEN. Lower-ranking cells were dropped earliest because they carried relatively little flow. Higher ranking cells were retained longer, and this implies that they are of higher priority. See table 1 for more information on the cells included in each rank.

Prioritisation analysis

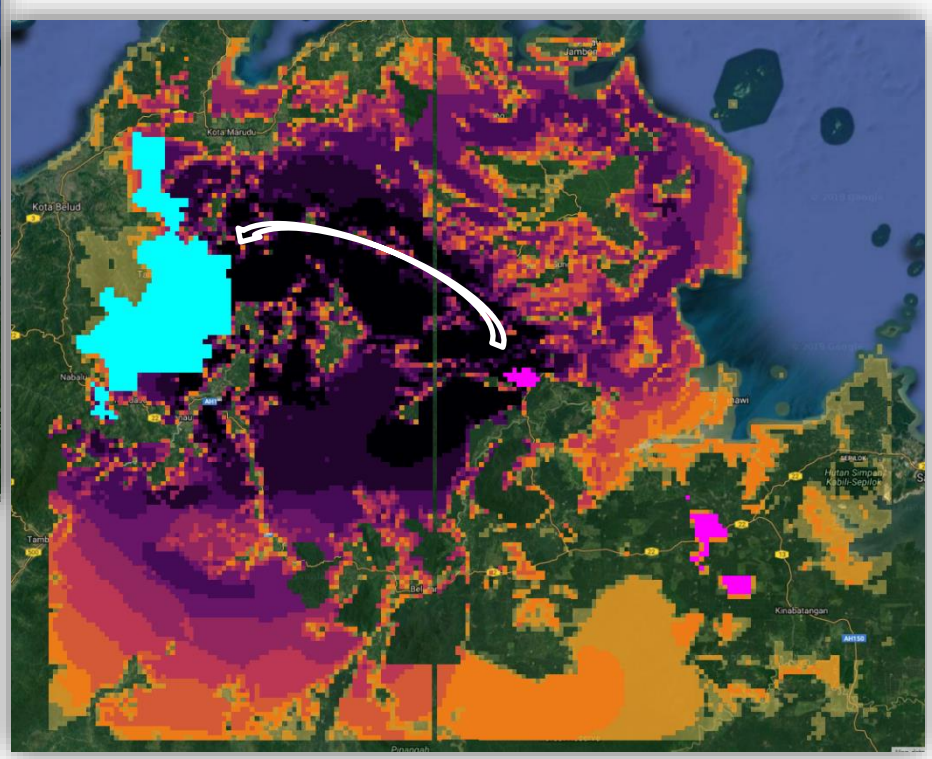
Given limited resources for conservation, which habitat patches are the most important to protect for long-term connectivity between lowland PAs and Mount Kinabalu?



PA1

Comparing ***Dropping Rank***

PA2



Synthesis

FLOW *analysis 1*

As the climate gets warmer, which routes will woodland populations take through the proposed Northern Forest region?

- We learnt how to use a simple auto-generated source and target
- We saw that, although deciduous woodland is far from continuous, there are several routes contributing to the overall flow

FLOW *analysis 2*

Which routes will heathland populations take to move from habitat patches in the south of England to those in the north? 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

PRIORITISATION *analysis 3*

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
- Just looking at flow alone in these landscapes would not have given such clear priorities of areas to save from logging

OF COURSE, ANALYSES LIKE THESE ARE ONLY THE BEGINNING OF YOUR TRAVELS

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Any Questions....please get in touch:

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