openModeller Practical

Obtaining specimen data

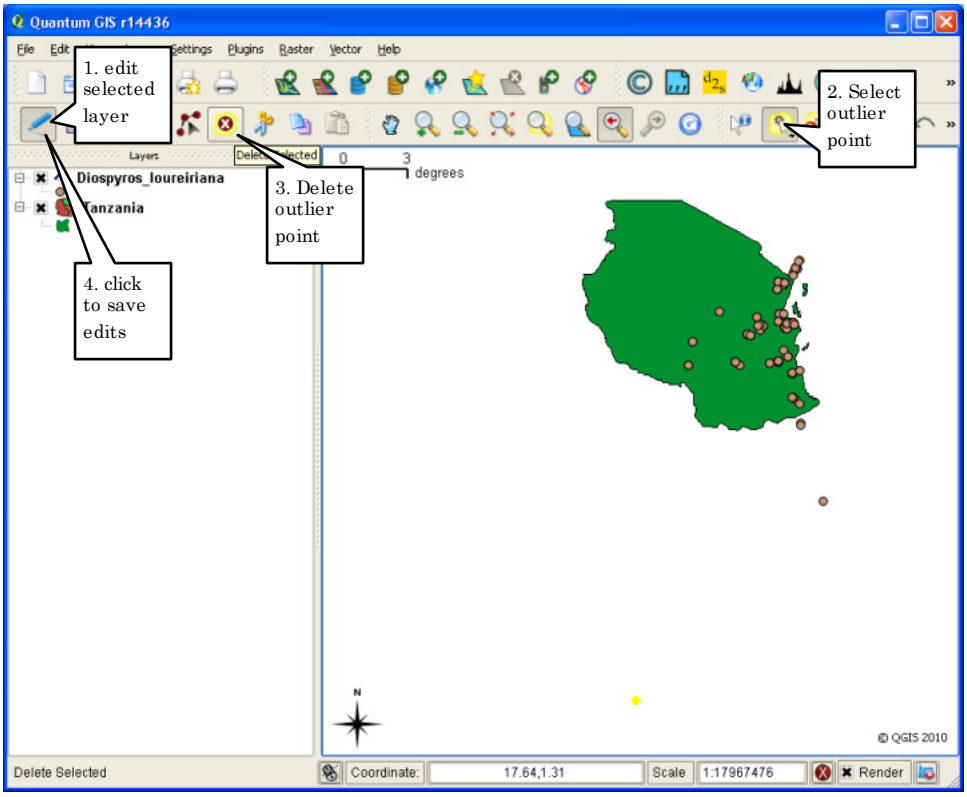
Before you can do any species distribution modelling you need some specimen data with associated point localities. For this practical we have prepared a sample file containing specimens from Tanzania.

Typically you would search for data by inspecting museum catalogues or searching through literature. The GBIF portal is a good place to start (http://data.gbif.org/). openModeller has a search utility that allows you to search GBIF for data and feed the results directly into your model. Instructions for this are provided as an appendix.

I have prepared an example using the star apple *Diospyros loureiriana*, an East African endemic shrub, using data from GBIF (including TanBIF). Data for this practical is in the Data directory in the handouts.

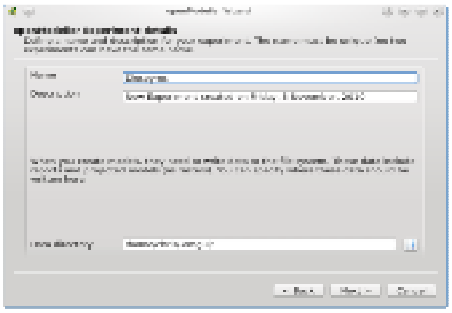
Modelling setup

- Start by opening a reference map (Tanzania.shp)
- open the file Specimens\Diospyros_loureiriana.shp in qgis
- check the distribution – some records are outside the reference map
- use the qgis edit function to remove the outliers
- *Note that removing outliers is not essential as these will be automatically excluded*

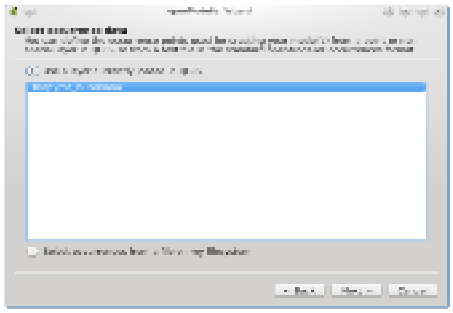


Modelling

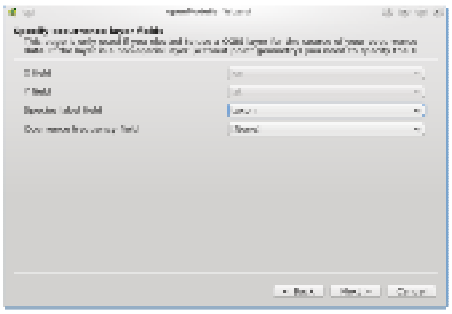
- open raster environmental layers for modelling, use present day climate data minimum & maximum temperature and precipitation (tmin, tmax, precip in Worldclim/Present/)
- select new experiment in the openModeller plugin menu
- follow the wizard instructions



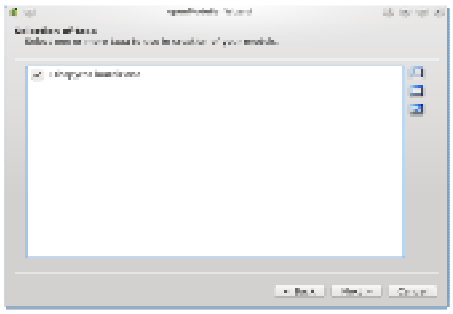
1. (left) Type in an experiment name – click next



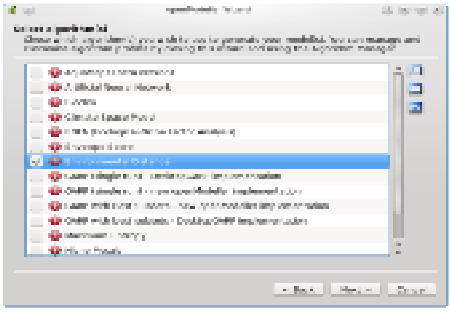
2. (right) Select the Diospyros data – click next



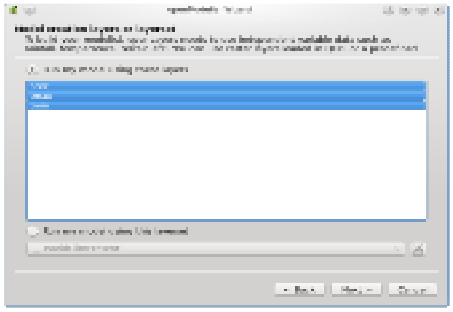
3. (left) Select species label field “taxon” – click next



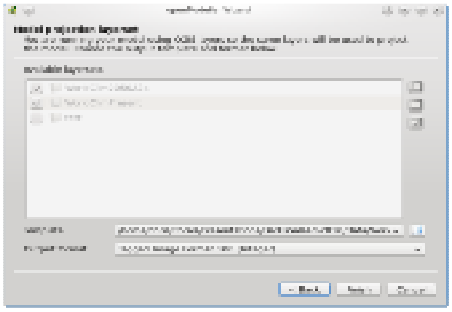
4. (right) Select taxon name Diospyros loureiriana – click next



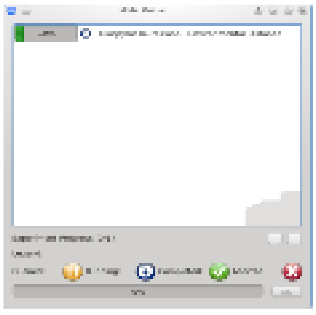
5. (left) Select algorithm “Environmental distance” – click next



6. (right) Select environmental layers “prec”, “tmin”, “tmax” – click next

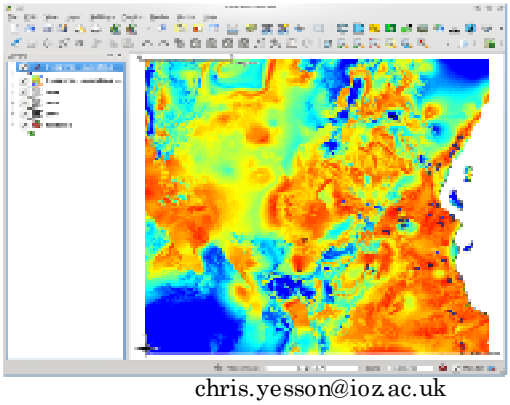


7. (left) Click finish to run the model



8. (right) Monitor progress of model run – Click OK when finished

- When finished your projected model will appear in QGIS as a raster layer. Red is high suitability (maximum=100), blue is low suitability (minimum=0). Move the occurrence data to the topmost layer to see if the model is a good fit to the data
- Your output should look like this



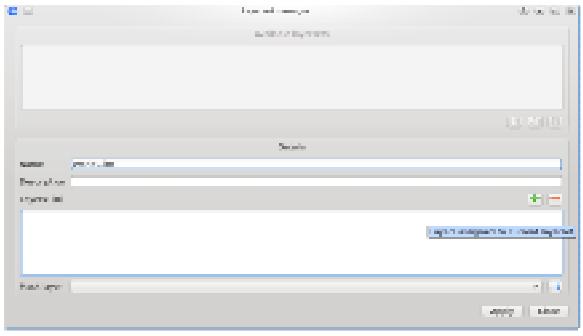
How do the results change if you use a different algorithm or environmental layers?

Using openModeller for climate change impact assessment

We can estimate distributional change in species occurrences by projecting our niche model into the IPCC future climate scenarios. To do this we have to find an equivalent set of environmental layers for a future period. We have 2 2050 scenarios

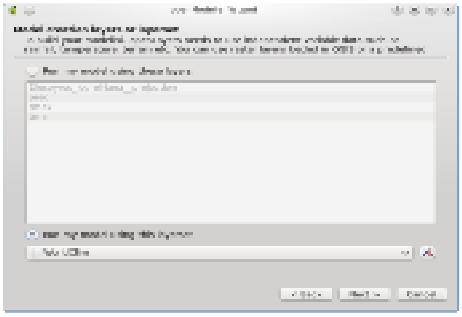
Preparation - creating layersets

- Open the layerset manager via the openmodeller plugin menu
- Give the layerset a name "WorldClim2050"
- Click the green plus to add layers
- Navigate to the WorldClim/2050 directory
- Select tmin, tmax, precip layers for scenario A2a (wc_30s_HADCM3_A2a_2050_prec.tif, wc_30s_HADCM3_A2a_2050_tmin.tif, wc_30s_HADCM3_A2a_2050_tmax.tif) and click OK
- Click apply in the layerset manager
- Repeat the process to create a new layerset called "WorldClim" for the present day layers prec, tmin, tmax



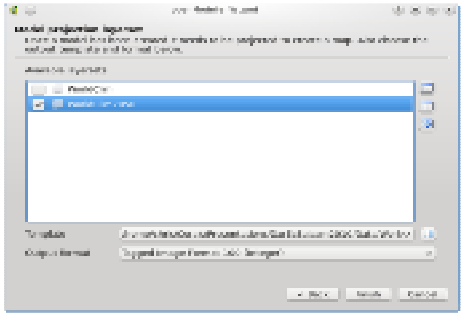
Modelling

- repeat steps 1-5 above

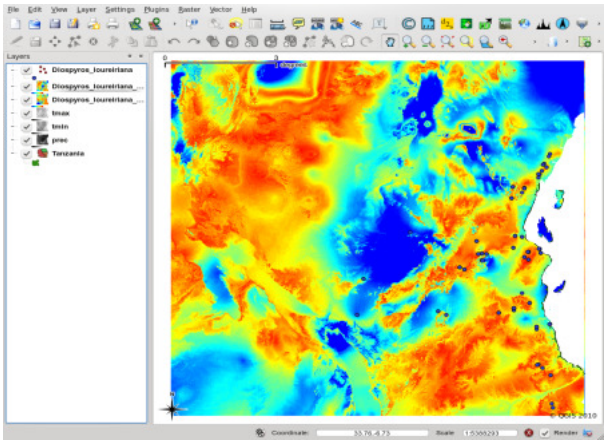


6. Select present-day worlddim layerset for running model – click next

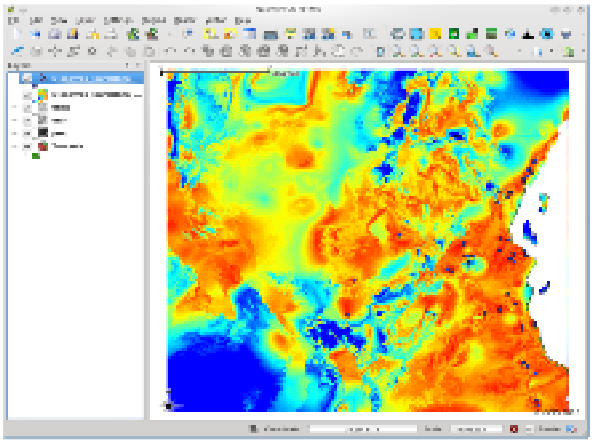
7. Select WorldClim2050 layerset for model projection – click finish



Predicted suitability 2050



Present suitability

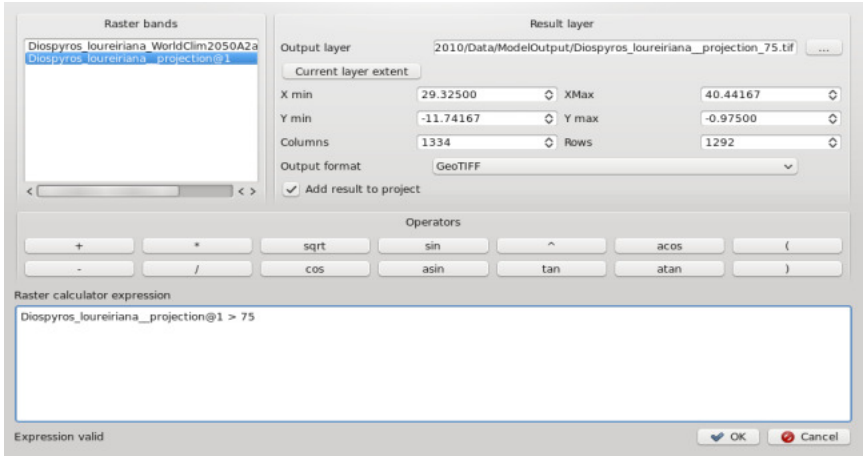


Using the raster calculator to select thresholds

A raster calculator performs simple arithmetic functions (add, subtract etc) on the pixels of raster grids.

- openModeller outputs a 0-100 score for each pixel, where 0 is entirely unsuitable and 100 is maximally suitable. In order to output a presence/absence map we must decide on a threshold value. We will choose a default value of 75
- If you have closed your model output layers, you can re-open them via the open experiment option in the openmodeller plugin

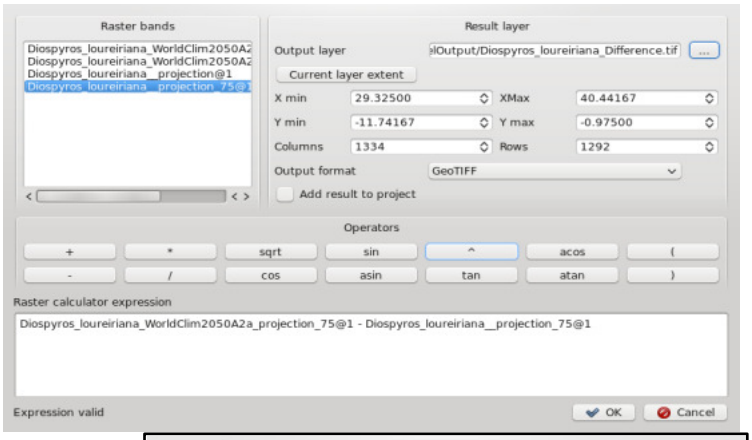
- open the raster calculator (in the layers menu)
- Double-click the present day projection
- In the "raster calculator expression" box type "> 75" after the file name
- Select a name for the output file in the output layer box (use "Diospyros_present_75.tif")



- Tick the box add result to project – click OK
- This creates a presence/absence layer (1=present)
- Now repeat this process on the future projection layer (create file "Diospyros_2050_75.tif")

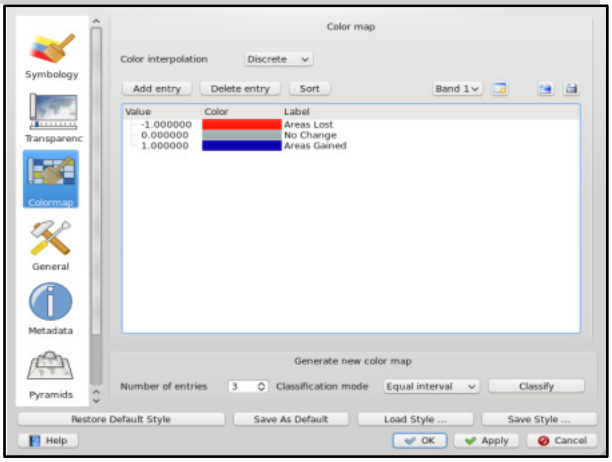
Examine the change in distribution

- open the raster calculator
- Subtract the present-day threshold layer from the 2050 threshold layer
- Create the output layer Diospyros_difference.tif
- Don't forget to check the box "add result to project"

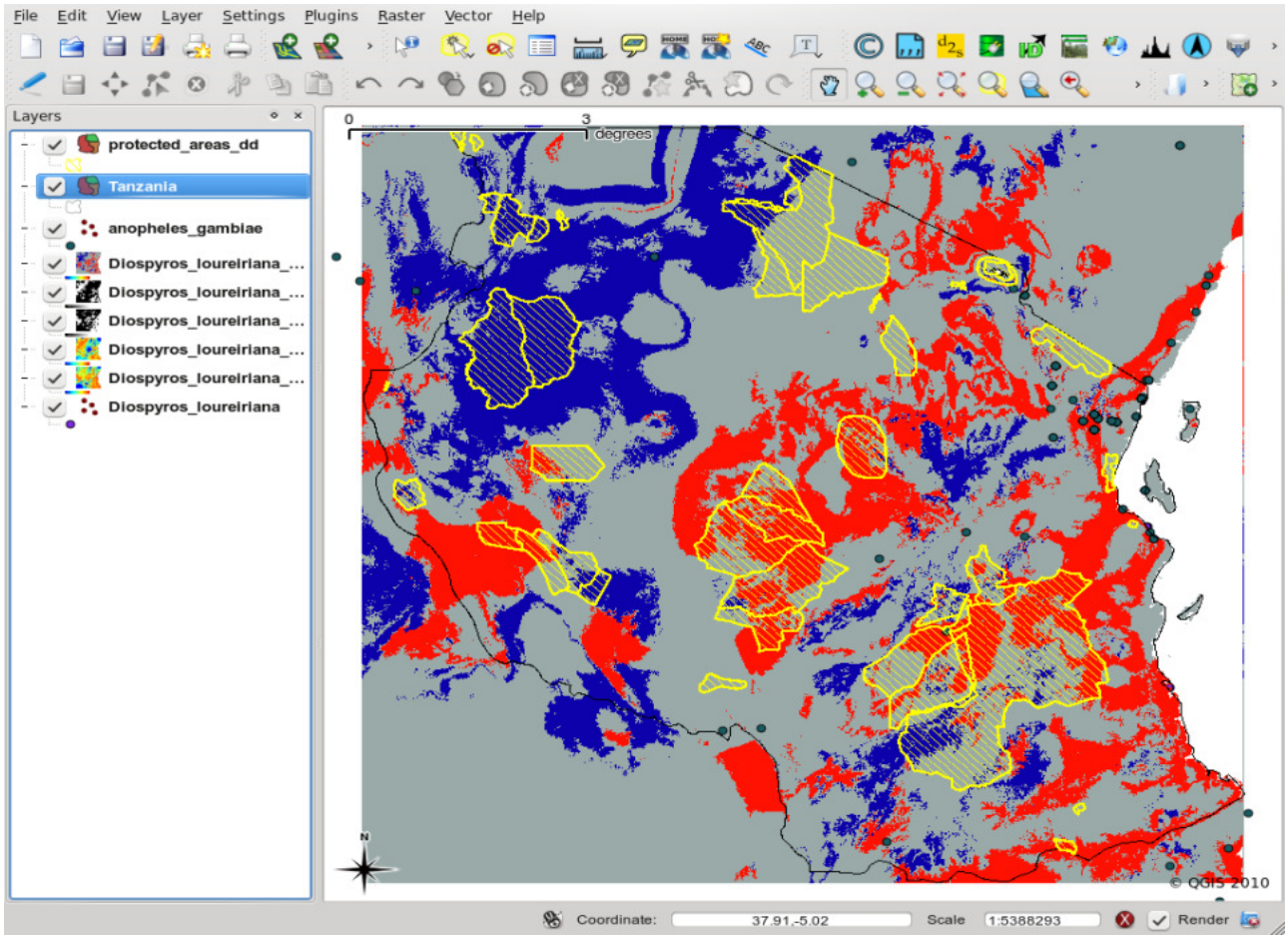


Display the differences

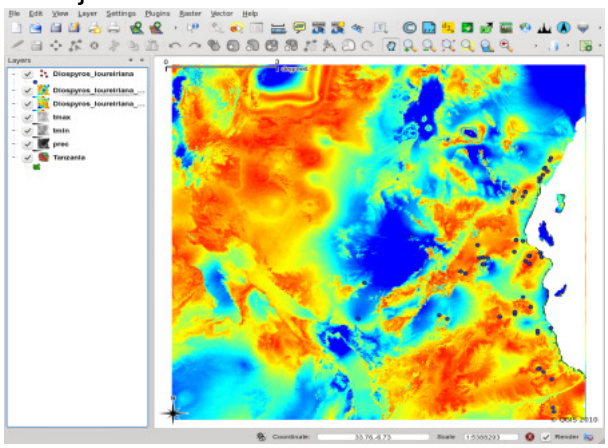
- double click the difference layer to view the properties
- in the symbology tab choose "colormap"
- select the colormap tab and change the colors as appropriate



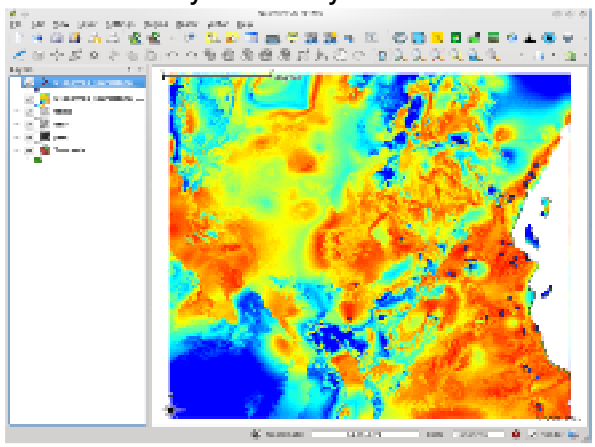
Projected change in distribution for Diospyros loureiriana
Red=areas lost, Blue=areas gained
Load the map of protected areas and overlay to see which might be affected



Projection for 2050



Present-day suitability



The file TanBIFoccurrences20101105.xml contains a download of TanBIF data from GBIF in Darwin core format. You could try modelling another species from this data set, or try fetching your favourite species using the GBIF search tool (details below)

Appendix - Fetching data from GBIF Using the openModeller search tool

There is a plug-in to openModeller which will search the GBIF portal and automatically download locality data in GIS formats

- select “search for locality data” from the openmodeller plugin
- check the GBIF terms and conditions box and click next
- type a a species name (anopheles gambiae) into the search term box and click the green plus
- the results will appear in the directory named in the “output path” box (change this as you see fit)
- click next to perform the search
- the results will be reported in a window like this, click finish when complete
- there will be an esrii shapefile named after your species (i.e. anopheles_gambiae.shp) in your chosen output directory
- check the data by opening the with qgis