Carabid Distributions within the Wet Tropics World Heritage Area

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Between July 21st and 23rd, 2010, Dr. Michael Kearney visited James Cook University, invited by the Centre for Tropical Biodiversity and Climate Change (CTBCC) and funded by NCCARF.

This visit was organized in order to collaborate on developing mechanistic models of distribution for biodiversity in the Australian Wet Tropics. This activity included training involving the use of NicheMapper, specialised software which creates these models. All this process was performed with Dr. Jeremy VanDerWal, CTBCC research associate.

The mechanistic models, based on complex physics formulas, calculates flux of energy between the organisms and their environments in order to determine the occurrence of organisms' physiological processes in defining geographical areas.

Major findings and outcomes of the collaboration

As part of this visit, NicheMapper was installed and tested in several computers in the CTBCC.

Dr. Kearney trained Ph D students of the CTBCC on the use and data requirements of NicheMapper.

The software tests were performed using information on ecophysiology of microhylid frogs of the genus *Cophixalus*. Andres Merino-Viteri, a CTBCC's Ph D student, provided this information.

NicheMapper does not have a user-friendly interface. Dr. VanDerWal started to develop programming scripts, to be used on R software, to make the process easier and faster. At the moment, the available version of this script allows to run the models in HPC facilities.

Additionally, Dr. Kearney started to adjust the software model for amphibians. A specific model for amphibian desiccation was developed and it is being used to test the water balance linked to the activity period on microhylid frogs in the Wet Tropics Region (See Figure 1).

Based on this modified script, Dr. VanDerWal developed a R script to run the model on future climate predictions. Some examples of the products are attached to this document.

Significance to adapting and protecting Australia's terrestrial biodiversity

The application of this methodology provides new information about the potential impacts of climate change on the Wet Tropic's biodiversity. Since this analysis requires specific parameters of the microclimate and physiology of the species, the products are also species specific. Parameters that may be affected by climate change in the future will be identified for each species.

The products of this analysis will help to focus conservation efforts. The results of the mechanistic models identify the specific biological processes, possibly affected by changes in the environments where the species occur. Conservation strategies based on this information may be formulated. Biodiversity and national parks managers will benefit because they will be able to focus financial and workforce efforts on specific tasks that will help the species to survive climate change.

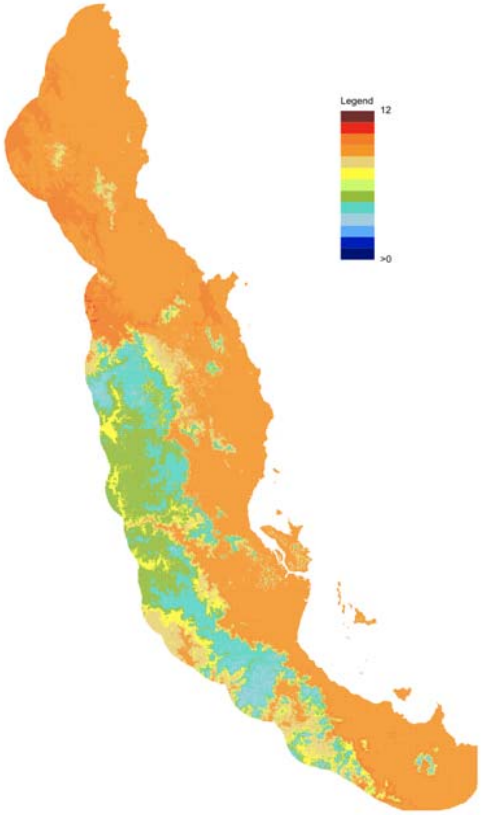
Future research suggestions

The development of mechanistic models provides specific information about threats to biological processes of specific species. Because of that, specific input data is needed from each species. The gathering of this information should be a priority if we want to understand how climate change is going to affect different species.

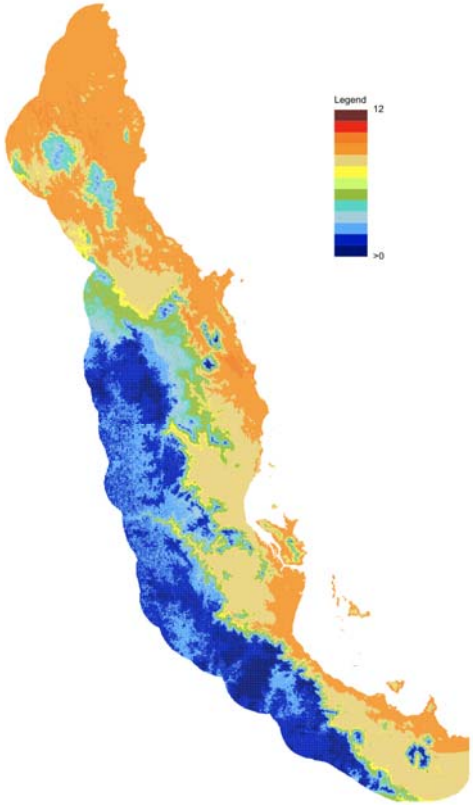
To promote extending the number of studied groups of animals with enough ecophysiology data to perform this kind of analysis should also be a priority.

Figure 1. Maps showing the predicted average number of activity hours per night during the coldest month (July) for the Bellenden Ker Nursery frog (*Cophixalus neglectus*) at present and under different scenarios of climate change in the Wet Tropics Region.

Scenario July present



Scenario July 2050



Scenario July 2070