**Model-based statistical inference in evolutionary biogeography**

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**Summary**

This course will cover the theory and practice of widely used methods in evolutionary biogeography, namely ancestral range estimation on phylogenies, statistical model comparison, and advanced techniques such as Biogeographical Stochastic Mapping, and trait-dependent dispersal modelling. The course will cover both the practical challenges to using these techniques (the basics of R, setting up the files and using the models), and the assumptions that various models and methods make. The course will also cover the statistical fundamentals behind model-based inference (likelihood, AIC, Bayesian techniques). R packages we will use include *ape*, *phytools*, and [*BioGeoBEARS*](http://phylo.wikidot.com/biogeobears).

**Requirements**

Training in the biological sciences, preferably some aspect of ecology or evolutionary biology. Participants must have a computer and be able to install programs (e.g. R, R packages). Prior experience with R is not required – we will cover the basics on day 1 – but will be helpful.

(Alternatively, students can use R Studio Cloud, a free R service that runs through their web browser.)

**Setup -** Please see email

**Workshop files:** download from <https://github.com/nmatzke/bgbwk>

* (click: Green “code” button, “Download .zip”)

**Outline**

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| **Monday 12 December (*BioGeoBEARS*, R)** | |
| 9:30-10:45 | Introduction to *BioGeoBEARS*  *lecture\_slides/01\_Matzke\_Noah\_to\_Darwin1\_v4.pptx*  *lecture\_slides/02\_Matzke\_biogeog2\_Darwin\_to\_models\_v2.pptx* |
| 10:45-11:00 | Morning tea (Robertson Tea Room) |
| 11:00-12:00 | Running examples of *BioGeoBEARS* and model comparison  *Psychotria\_M0\_equalRates – same script here:*  [*http://phylo.wikidot.com/biogeobears#script*](http://phylo.wikidot.com/biogeobears#script)  *Psychotria\_M2\_oneWayDispersal*  *Psychotria\_M4\_DistanceDispersal* |
| 12:00-13:15 | Lunch (not provided, but plenty of options on [campus](https://kambri.com.au/eat-drink-shop/" \t "_blank)) |
| 13:15-15:15 | Bayesian Stochastic Mapping  */GitHub/bgbwk/Psychotria\_M4\_DistanceDispersal/  Psychotria\_M4\_DistanceDispersal\_DECjx\_BSM\_v1.R*  */GitHub/bgbwk/Psychotria\_M4\_DistanceDispersal/*  *Psychotria\_M4\_DistanceDispersal\_DECx\_BSM\_v1.R* |
| 15:15-15:30 | Afternoon tea (Robertson Tea Room) |
| 15:30-16:30 | Advanced customised options in *BioGeoBEARS* |
|  | *Trait-dependent dispersal models:*  */GitHub/bgbwk/conifer\_DEC\_traits\_models /GitHub/bgbwk/conifer\_DEC+x\_traits\_models*  Time-stratification (as time allows):  */GitHub/BioGeoBEARS/inst/extdata/examples/Psychotria\_M1strat /GitHub/BioGeoBEARS/inst/extdata/examples/Psychotria\_M2strat /GitHub/BioGeoBEARS/inst/extdata/examples/Psychotria\_M3strat /GitHub/BioGeoBEARS/inst/extdata/examples/Psychotria\_M4\_dists* |
| **Tuesday 13 December (*PhyBEARS*, *Julia*)** | |
| 9:30-10:45 | Introduction to *Julia* language / setup |
| 10:45-11:00 | Morning tea (Robertson Tea Room) |
| 11:00-12:00 | Introduction to *PhyBEARS* |
| 12:00-13:15 | Lunch (not provided, but plenty of options on [campus](https://kambri.com.au/eat-drink-shop/" \t "_blank)) |
| 13:15-15:15 | Model comparison with *PhyBEARS* |
| 15:15-15:30 | Afternoon tea (Robertson Tea Room) |
| 15:30-16:30 | Advanced topics |