Project title: Modelling the present to understand the future of tropical rainforests.

Project leader: Dr. Roy H.J. Erkens (Maastricht Science Programme)

Function: Lecturer Evolutionary Biology

Collaborators: Prof. Dr. T.J. Cleij (Maastricht Science Programme)

Proposal (250 words):

Introduction: Tropical rain forests hold most of the plant diversity on earth but biologists have no proper explanation for this. Modelling the climatic niches of species can contribute substantially to our understanding of the composition of such forests. Large, widespread and well-studied plant groups can serve as a model system for such research. Annonaceae is a pantropical plant family that contributes significantly to tree diversity in rain forests around the world but little is known about the variables determining the distribution of its species and the ecological causes for speciation.

Hypothesis and Objectives: Main aim is to investigate the ecological factors responsible for tropical rainforest evolution. Subquestions addressed are: 1) do correlations exist between Species Distribution Modelling (SDM) predictions, ecological inventories and evolutionary relationships, 2) are there differences in ecology between evolutionary groups within Annonaceae, and 3) do different rainforest have different ecological characteristics?

Setting and Methods: SDM will be used to estimate climatic niches of all 2450 species in Annonaceae. This modelling data will then be combined with real biological data from paleontological sources and from plot inventories on several continents. All data will be interpreted in an evolutionary framework.

Impact: The understanding of climatic niches can be used to fundamentally understand the origin of tropical forests but also to forecast the response of these forests to future climate change. Both approaches are needed to enable effective conservation strategies. The outcome of this work will also be used to make IUCN Redlist assessments for all species of Annonaceae.

Requirements candidate: Highly motivated student with good English communication skills and proactive and resolute attitude, programming capabilities, modelling skills, basic understanding of ecology, basic understanding of phylogenetic methods.

Keywords: evolution; tropics, species distribution; climatic niche; modelling; plants

Top 5 selected publications:

1. Bystriakova, N., Peregrym, M., Erkens, R. H. J., Bezsmertna, O., & Schneider, H. (2012). Sampling bias in geographic and environmental space and its effect on the predictive power of species distribution models. Systematics and Biodiversity, 10(3), 305-315. doi:10.1080/14772000.2012.705357

2. Couvreur, T. L. P., Pirie, M. D., Chatrou, L. W., Saunders, R. M. K., Su, Y., Richardson, J. E., & Erkens, R. H. J. (2011). Early evolutionary history of the flowering plant family Annonaceae: steady diversification and boreotropical geodispersal. Journal of Biogeography, 38, 664-680.

3. Erkens, R. H. J., Chatrou, L. W., & Couvreur, T. L. P. (2012). Radiations and key innovations in an early branching angiosperm lineage (Annonaceae; Magnoliales). Botanical Journal of the Linnean Society, 169(1), 117-134. doi:10.1111/j.1095-8339.2012.01223.x

4. Hoekstra PH, Wieringa JJ, Smets E, Brandão RD, Lopes JdC, Erkens RHJ, Chatrou LW (2017) Correlated evolutionary rates across genomic compartments in Annonaceae. Molecular Phylogenetics and Evolution 114: 63-72.

5. Chatrou L.W., M.D. Pirie, R.H.J. Erkens, T.L.P. Couvreur, K.M. Neubig, J.R. Abbott, J.B. Mols, J.W. Maas, R.M.K. Saunders and M.W. Chase (2012). A new subfamilial and tribal classification of the pantropical flowering plant family Annonaceae informed by molecular phylogenetics. Botanical Journal of the Linnean Society 169(1): 5-40.