Quercus PhD Project Proposal

Title: Global trends in the *Lagomorpha*	**Project code:** G1017BSC (sub-analysis QUERCUS)
Student:	A.N. Other *(to be advertised)*
Supervisor(s):	Dr Neil Reid (1st) Dr. Alison Cameron (2nd) Prof. Ian Montgomery (3rd)

Project Outline (100 words max):

This 3 year studentship aims to examine the processes which contribute to the global distribution of Lagomorphs worldwide including biogeography, ecology and interspecific interactions, specifically the phenomenon of near universal allopatry between adjacent species of similar Genera. The project will also examine the responses of the Order to climate change and their physical adaptations which contribute to their ecological niche separation. This project will work on a global scale using modelling approaches and will compliment a second studentship that will work in the field locally to examine similar issues between invasive European and native Irish hares in Ireland.

Type *(Please tick)*:	Full project ☐	Short Contract ☐	Studentship ☑	Other ☐

Starting date: 01/04/2012	**End date:** 31/03/2015	**Duration:** 3 years

Objectives and Methods:

Methodological approaches will largely focus on meta-analyses of existing databases, modelling with some museum and laboratory based data collection.

1. *Determine biogeographic correlates of range size and the likely impact of projected climate change on the Order Lagomorpha.*

   Standard maximum entropy style modelling of the ranges of all 92 species of lagomorphs (polygon shapefile for the range of each species is downloadable from the IUCN website) with low, medium and high emissions scenarios including Normalized Difference Vegetation Index (NVDI) where the index is also modelled under each climate scenario (i.e. including the likely impact on habitat). The differential responses to climate change may be grouped using a cluster analysis to determine groups of species within the Order that will respond in similar ways providing a means by which to generalise species responses. This has not been done for this Order.

2. *Determine the role of interspecific interactions in creating the observed pattern of range exclusivity (allopatry) in the Lagomorpha.*

   Develop ecological niche modelling further to incorporate competitive exclusion and competitive release at species range boundaries. This can be achieved by taking the final models from Objective 1 and integrating the predicted probabilities for co-occurring or spatially adjacent species into each species model and looking at how each species responds to its neighbours. This may provide generalities about transient sympatry and the *status quo* of allopatry within the Order Lagomorpha.

3. *Contrast correlative models with mechanistically derived models using known species tolerances rather than observed ranges.*

   Construct a database of life history traits for each lagomorph species (downloadable from the YouTheria data portal) including body mass, karyotype, energetics, climatic tolerance and habitat niche. A mechanistic model of each species distribution will be created using NicheMapper to contrast with those predicted by more traditional bioclimatic models (Objectives 1 and 2). Life history traits that are determinants of each species' range will be examined using phylogenetically controlled analyses. Inferred interspecific interactions, such as competition will be through ecological similarity of co-occurring species ranges.

4. *Determine the adaptive characteristics of a major group within the Lagomorphs (for example, the Genus Lepus) by integrating morphometry with phylogenetics.*

   Many adjacent species of Lagomorphs, particularly hares, are capable of interbreeding with 16 sub-species of mountain hare (*Lepus timidus*), the Arctic hare (*L. articus*) and Alaskan hare (*Lepus othus*) forming a putative circumpolar 'ring species'. To determine interspecific relationships using physical adaptation (rather than neutral genetic markers) we will analyse mandible shape to create a contrasting phylogeny to already published genetic data providing further data on interspecific similarities and potential for ecological competition.

5. *There is scope for further development of the project by the successful candidate.*