**Hot, hungry, and tired: individual-based models of animal dispersal using energetics and climates**

A prevailing challenge in ecology is accurately forecasting species responses to environmental change. Constraints on dispersal interact in complex ways with the physiology of the animal (metabolism) and physical environment (food and microclimates), but can be modelled using physical principles of energy and mass exchange. Under a changing environment, a first principles framework of how animals budget their energy, heat, and water usefully captures individual movement and dispersal potential by connecting the common, key drivers sensitive to this type of change. We model these constraints in a spatially explicit individual-based model (IBM) to simulate how animals survive in landscapes of varying food and weather. To illustrate the model, we run simulations of the Australian sleepy lizard *Tiliqua rugosa* under different movement strategies (optimising and satisficing) in contrasting habitats of varying food and shade. By explicitly incorporating physiology, behaviour, movement strategy, and movement costs, we generate activity and time budgets, home range outputs, spatial movement patterns, and life history consequences under user-defined configurations of food and microclimates. Our results show 1) the extremes of movement behaviour is consistent with feeding requirements (passive movement) and microclimates (active movement), 2) using general mechanisms such as energy use can realistically capture home range size, and 3) a satisficing movement strategy is more efficient in energy costs despite similar heating and cooling rates to optimising movement, which was energetically more expensive and returned no additional benefit in metabolic fitness outputs. Using the general mechanism of energy use, this type of modelling provides a bottom-up framework to understand complex movement patterns and behaviour for different scales and taxa, as well as forecast future responses of species to novel habitats under certain human-induced climate change.