

Modelling dispersal and population stability of the North America red squirrel over a disturbed landscape

Stephen M. KRONE¹, Rebecca C. TYSON², and Karl W. LARSEN³

¹University of Idaho, Moscow, Idaho, USA (krone@uidaho.edu)

²University of British Columbia, Okanagan, Kelowna, British Columbia (rebecca.tyson@ubc.ca) ³Thompson Rivers University, Kamloops, British Columbia, Canada (klarsen@tru.ca)

Methods:

The combination of commercial forestry and widespread forest insect epidemics has drastically altered the conifer forests over much of the Pacific Northwest region of North America. As an extension of field work on the North America red squirrel, we are using a simulation approach to investigate how populations of red squirrels (*Tamiasciurus hudsonicus*) respond to these landscape changes. The computational model is individual-based, spatially explicit, and stochastic, i.e. a 'stochastic cellular automata'. It is a discrete approximation of a process that is continuous in space and time. With it, we can integrate important features of squirrel behaviour such as territoriality, midden development, and dispersal over short and long distances. This framework allows us to investigate the response of squirrel populations to spatio-temporal disturbance (e.g. harvesting, fire) given different initial forest mosaics.

Results:

From our simulations, we can determine spread rate into regenerating forest as a function of time and distance from the mature forest edge, survival and success rate of emergent juveniles, distribution of dispersal distances for juveniles who are successful in finding vacant territories, survival of squirrels in immature forest, and vacancy rates in springtime. We can also ask how these population measurements are affected by the size of harvested or burned patches and rotation interval.

Discussion:

At present, the results suggest that the size, amount, and dispersion pattern of young forests over the landscape can affect population structure and stability. A 'tipping point' may exist, at which the ability of the red squirrel population in established forests to export sufficient numbers of dispersers over the landscape becomes questionable. This in turn may have significant impacts on those species that predate on red squirrels. This work will ideally provide hypotheses that we can test with future directed field research.