Biol 463/663 – Conservation Biology Name _____

Metapopulation homework – due 11/7/18

Answer the first, numbered set of questions based on the **Levins model** of metapopulation dynamics.

1. If the probability of extinction is set to 0, what is the equilibrium proportion of sites occupied? Does it matter how much movement occurs (why or why not)?

2. If extinction rates are bigger than movement rates, will the metapopulation persist? How do you know?

3. If the extinction rate is less than movement rate, will the metapopulation persist? If e is greater than 0, but less than m, will all of the patches be occupied? How do you know?

Answer the remaining questions using the **metapopulation simulation app**.

Question A. What is the typical proportion occupied with m = 0.5 and e = 0.1?

Question B. What happens to p when m = 0.95 and e = 0.1? Do you ever get unoccupied patches? Do they stay unoccupied long?

Question C. With m = 0.1 and e = 0.01 do you still get extinctions? Do they stay vacant for longer than in A or B?

Question D. With m = 0.9 and e = 0.09 the expected equilibrium proportion occupied is 90%, the same as for Question C. Are the dynamics the same? Specifically, when a patch becomes unoccupied, does it stay unoccupied for as long as in Question C?

Explain why the dynamics are different for C and D, even though the equilibrium patch occupancy is the same. Does the equilibrium value for p tell you everything you need to know about how the metapopulation will behave?

E. With m = 0.01 and e = 0.01 is the metapopulation stable? Does it decline quickly?

F. With m = 0.95 and e = 0.95 is the metapopulation stable? Does it decline quickly?

Explain why E and F are different – both have an equilibrium value of 0 for p, why are the dynamics different?

G. Was the metapopulation stable with m = 0.6 and e = 0.5? Should it have been, according to the Levins model? How big did m have to be to produce a stable metapopulation when e = 0.5? Why was a bigger m needed than the Levins model predicts (hint: the app is stochastic)?

Thought question: Ecologists often infer a species' habitat needs by seeing what habitats it occupies. Based on the metapopulation model you have worked with, would it be safe to assume that a patch of habitat is unsuitable for a species just because you don’t find the species there? Why or why not?