Key to Quiz Questions—Week 6 (Forests through time and space)

1. Using the following fictional scenario:

> *Two species of bark beetles have been deposited in the Pacific Northwest by a long distance windstorm that flew them in from the East Coast. In their native habitat they existed in allopatry, but are sympatric on the West coast. They are both best able to take advantage of the resource that Doug Firs provide, so are in competition with one another.*

Describe three possible outcomes of this competition, giving as many plausible details as you can.

Answer: If you described the three possible outcomes accurately, but without specific reference to the bark beetles and their situation (that is, without details), you got 8 pts. If you confused the three outcomes somewhat, but gave some good details, you got between 5 – 8 points.

1. Competitive exclusion: The two species are using exactly the same bark on exactly the same trees in exactly the same way, at exactly the same time of year—and in so doing, one species drives the other extinct, leaving the remaining extant species without competition, at least for now.
2. Resource or niche partitioning: The two species divvy up the resources (food, space, housing, etc.) that they are using, such that they are no longer in direct competition for exactly the same resources. Examples of such partitioning in bark beetles might include utilizing different heights of the same species of tree, staggering timing of reproduction, or (less plausibly) using different depths of bark or being active at different times of day (changes in circadian patterns).
3. Modification of one or both species' anatomy or physiology, such that the species are no longer in direct competition. Say the jaws on these beetles are a good fit for the bark of Doug fir, but a mutation in one species allows that individual to take advantage of the stringier bark of the Western red cedar. If that mutation does not also have costs associated with it, it may spread as an adaptation to avoid direct competition with the bark beetle that is still dependent on doug firs exclusively.
4. Another acceptable answer, not as likely but possible nonetheless is that the bark beetle competition overwhelms the resource they are using, and they drive the doug firs locally extinct, thus causing the bark beetles to go locally extinct as well. There were a few other plausible answers as well.

2. Why are the forest fauna on either side of Wallace's Line so different from one another? Make sure to include both vicariance and dispersal in your answer.

Wallace's Line is between Borneo and Sulawesi, and east of Bali. Effectively, this invisible line separates the fauna of Asia and Australia. West of the line live relatives of Asia-derived species (from Laurasia); east of the line are primarily animal species that are Australian (Gondwanan) in origin. Reconstructions of ancient land mass positions, and the placement of tectonic plates, reveals that underneath Wallace's Line is a drop in the sea floor—a subduction zone—meaning that the islands East and West of the line came from distinct landmasses, and no land bridge ever formed in the region. Thus, vicariance largely explains the divergent faunas on either side of the line, even though many of the islands are currently very close in space to one another. A few species are now found on both sides of the line—such as some bird species, which can fly across aquatic barriers—which is evidence of dispersal. Rafting and other "filter bridges" are also possible modes of dispersal across Wallace's Line, although dry and seasonal forest immediately East of the line poses barriers to dispersal. (Also: land bridges were never likely at Wallace's Line itself, but did connect Australia and Papua New Guinea, and some of the smaller islands east of the line.)