

## Key for Quiz, Week 2, Winter Quarter 20 points total

1. Incorporating your knowledge of vicariance, dispersal, and the predictions of island biogeography theory, how do you think the species richness and diversity of the Seychelles compare to that of Madagascar? Give specific evidence of your thought process. You may want to consult the following site for more information on the Seychelles: [http://www.phelsumania.com/public/articles/biogeography\\_plateau\\_1.html](http://www.phelsumania.com/public/articles/biogeography_plateau_1.html)

This was a very tough question, and credit was given for excellent effort even when conclusions were stated too strongly for the evidence. Mostly this is in reference to the origin of the Seychelles, which obviously impacts your answer to the rest of the question. There are several hypotheses out there now on the origin of the Seychelles; broadly stated, they are that the Seychelles are entirely Gondwanan in origin, entirely volcanic, or some mix of the two. The best thinking today supports the final idea. Finally, competent answers that didn't say anything wrong, but also didn't give sufficient detail to really assess your understanding, got 5 points, or half credit.

If *some* of the Seychelles are Gondwanan (tectonic) in origin, those islands originated from granitic upwelling in the Mascarene plateau while Madagascar and India were still connected, around 65 million years ago, and thus while the newly formed granite, including parts of modern India and some of the islands in the Seychelles, were all still connected to Madagascar. Implications for relative biodiversity on Madagascar and the Seychelles is that whatever organisms were on that large landmass at the time would have piggy-backed onto Madagascar, India, and the tectonic-origin Seychelles islands and continued evolving once there. Organisms with their origins on that original landmass (a vicariance explanation) probably diversified to a greater extent on Madagascar than on Seychelles islands, as it is bigger and thus has more niches.

Some additional islands in the Seychelles are probably volcanic in origin. Thus, any organisms on those islands necessarily dispersed there. Marine currents (or trade winds, for some durable seeds or spores) are primarily responsible for the diversity on those islands, and their great distance from most other source populations presumably restricts species richness on those islands. This begins to get at the island biogeography aspect to the question. The predictions of island biogeography are two-fold: on islands, diversity increases with proximity to a source population, and with the size of the island. Thus, assuming that modern organisms were dispersing at least to the volcanic islands of the Seychelles, and to some degree to the Gondwanan-origin ones as well, those closest to Madagascar, and largest, are most likely to have high diversity on them. But Madagascar's size is more than three orders of magnitude (more than 1,000 times) larger than the total size of the Seychelles, and its mass is contiguous, whereas they are a series of islands. The difference in size alone predicts that Madagascar will be much more diverse, because more organisms started out there, more could survive there, more could compete there, and more would arrive there by dispersal.

2. Give three examples of how Malagasy cultural traditions have impacted Madagascar's forests. For each, explain the nature of the impact: Have they been positive or negative, in what ways, under what conditions, and to what extent. For each example, address whether its impact has always been like this (consider the tragedy of the commons in your answer).

This was not such a tough question, although many students easily described two traditions, and included a third that was a real stretch. There are several possible answers to this. Somewhere in your answer you must address the tragedy of the commons (or max 8 points). In this answer (which includes more examples than you needed to supply), the tragedy of the commons is discussed in the final paragraph. So, for answer, if you gave two good answers, but did not mention the tragedy of the commons, you got 5 points.

*Tavy* rice cultivation: It is likely that the original Malagasy people brought rice with them to Madagascar 1500 years ago, so rice has been an integral part of Malagasy culture since the beginning of Malagasy culture. As an old, original tradition, *tavy* has thus been proven effective, simply by the test of time. Until fairly recently, when the human population began to grow at heretofore unseen rates, *tavy* was sustainable. *Tavy* is good for people in that it has a short crop cycle (you can generate food quickly), and does not require as much maintenance as rice paddies. *Tavy* is good for forests because forests can regenerate quickly and different fields are at multiple successional stages. *Tavy* is bad for people at high population density, and when the government starts fining people for it. *Tavy* is bad for forests at high population density because forests can't regenerate, and when the government fines people, they move deeper into forests to slash and burn in the interior, where they can't be fined (or found) by the taxman.

Cattle as a sign of the patriarch's wealth and power: Cattle are always bad for forests, even when important to local cultures. At low population densities, there are few enough cattle, and plentiful enough native grasslands and savannah-woodland, for cattle to be able to range without doing much harm to forests (although they still cause erosion and do other physical damage with their hooves and teeth). At higher population densities, there are both more pressure on the remaining forests, and more cattle, since the number of cattle is positively correlated with the number of patriarchs, which is roughly correlated with total population size.

Several *fadys* impact Madagascar's forests, especially the wildlife and the burning regimen. Those that came up in class include the *fady* against eating or killing indri, because indri are considered close relatives of humans, and legend has it that one once saved a man. This is protective of indri, a charismatic forest inhabitant. Another *fady* is that to see an aye-aye and not kill it will result in the death of someone in your village. This has obviously resulted in the killing of many aye-aye, which potentially puts the species at risk of extinction, which in turn would change the faunal make-up of the forest. On the other hand, if a significant fraction of aye-aye were selected to be wary of

people when sympatric with the “kill the aye-aye” *fady*, the species would evolve to comprise entirely shy and reclusive aye-aye, which might be bad for ecotourists and researchers, but not for the aye-aye, or for the forest. Finally, another *fady*, in a different part of the aye-aye’s range, is protective of aye-aye, and this will have a positive effect on aye-aye’s and forests.

Other plausible answers might deal with the hunting of lemurs (bushmeat), rice paddy agriculture, forest fear, and, to a lesser degree, things like ancestor worship and the turning of the bones, although you would have to really sell this point.

The tragedy of the commons is relevant to all of these traditions in that they are typically sustainable at low population density, when resources are effectively infinite to individual groups of people, but as population grows and neighboring tribes start to compete for space and resources on the land, there is no reason for any one village (or person) to stop their traditional practices “for the good of the group,” as the other, competing interests will just get more. The tragedy of the commons identifies the problem: when a commons (in this case, some forest product) is available for use, everyone will use it maximally until it is all used up; the solution must be regulation by and for all stakeholders, such that the long-term interests of everyone are adequately served.