Key for Quiz, Week 1, Winter Quarter
30 points total

1. *Compare and contrast the economic and ecological costs and benefits of slash and burn (swidden) agriculture with monocropping in modern tropical regions that have recently been converted from forest. Give specific examples of each type of agriculture, and the ways that it fails and succeeds.* (15 points: 10 total for compare and contrast; 5 for specific examples.)

Ecological costs of swidden are relatively low, at low population densities. It is sustainable and readily converts back to forest, when done in traditional cycles, such that land is reclaimed by forest between crop years. The ecological costs of monocropping, especially in recently forested land, are very high, as biodiversity is reduced to a single species, and agrochemicals are applied abundantly, especially fertilizers to replace nutrients that are leached, and pesticides to replace native predators.

Ecological benefits of swidden are high, as forest is almost constantly regrowing, and succession proceeds almost as quickly as in intact forest. By contrast, ecological benefits of monocropping are essentially non-existent.

Economic costs of swidden are that no initial investment means no capital return either. Swidden works for subsistence farming, not to turn a profit. For monocropping, the short term economic costs are moderate, as this system requires high input of capital, for machines and chemicals. Long term, economic costs increase, as shade-tolerant species that are forced to grow in full sun conditions are affected in terms of yield (reduced); susceptibility to pests and pathogens (increased, requiring more input of agrochemicals); and flavor (decreased, affecting the price consumers are willing to pay).

Economic benefits of swidden are that it takes no start-up: you don't need capital to begin swidden agriculture. In systems with an abundance of labor but few resources, this is important. Economic benefits of monocropping differ by stakeholder: corporations are greatly benefited, as returns are easy to predict, and not highly variable from year to year, when crops are machine-harvested and labor input is low. Economic benefits to consumers are moderate, as monocropping produces a lot of uniform food, but quality is affected. Economic benefits of monocropping to farm workers are low.

Crops traditionally grown with swidden include rice, other grains like millet, corn, beans, and root crops like cassava and sweet potatoes. All traditional crops succeed in the region and at the population density that they have been practiced for hundreds or thousands of years, with relatively minor long-term ecological degradation. When swidden expands, it is usually due to population pressure, which decreases the sustainability of traditional practices, especially when the time cycle of crop rotation (the amount of time fields are allowed to lie fallow) is shortened, and the distance to source forest from fields is increased.

Monocrops in the tropics include coffee and bananas, among many others. Both can be successfully grown in monocrop systems, although flavor is affected, large inputs of chemicals are required, and the labor force has little bargaining power and is often exposed to dangerous toxins, as is the environment surrounding these farms. Both coffee and bananas are understory plants in their wild state, so monocropping increases growth rate and fruit production, but competitors, herbivores and pathogens have to be carefully excluded, with a little help from your friend and mine, synthetic chemicals.

The biggest problems with answers to this question were 1) no specific examples (for a maximum of 10 pts); 2) making sweeping statements without any support, or directly quoting the lecture notes; 3) failing to make reference to the specifics of the question. For instance, monocropping will have different effects on recently forested land than on land that has been under cultivation for many cycles already.

2. *List and explain in detail four specific edge effects that occur at boundaries of tropical forests. Knowing these, how might your design of protected areas be affected?* (15 points total: 10 points for specific edge effects; 5 for effects on design of protected areas.)

Five specific edge effects include:

1. Increased insolation (solar radiation): ↑ Temperature (T) and ↓ humidity
2. Increased wind penetration: effects boundary layers, usually ↓T *and* humidity.
3. Soil moisture is lower, and evapotranspiration rate higher, in part due to 1 and 2. Regionally this can affect rainfall and ecosystem-wide water budgets.
4. Structural damage more likely at edges—storms knock down trees and open up niches, which ultimately alters species composition.
5. Growth rate of seedlings of canopy trees and understory plants increases within 25m of forest edges.

Following the workshop and discussion on Friday Jan 14 regarding the criteria for establishing national parks, we would accept most well-thought answers to the 2nd part of this question, as you are all well aware of how many competing interests and needs there are in conservation. Broadly speaking, knowledge of edge effects suggests that 1) large areas, 2) with borders that minimize edge : area ratio, with 3) buffer zones that effectively leave little or no protected area at edges, and 4) corridors between fragments are all important parameters in reducing edge effects.