Oct 25, 2004

Name: _____ Pledge: _____

Environmental Studies 201 Test #2

Point Total: 100 pts possible

8 pts 1. What were the main crops cultivated by the Rapa Nui, the inhabitants of Easter Island?

According to Jared Diamond ('Easter's End'):

- bananas
- taro
- sweet potatoes
- sugarcane
- paper mulberry

8 pts 2. (a) List the items—as many as you can—that Garrett Hardin named as 'public commons' in his two essays, "The Tragedy of the Commons" and "Lifeboat Ethics."

- fisheries
- federal grazing land
- national parks
- the ability to assimilate waste/pollution
- the freedom to breed
- the World Food Bank
- unlimited immigration

8 pts (b) What are the important characteristics of a lifeboat that, according to Garrett Hardin, describe the situation on planet Earth?

According to Hardin, the situation on Earth is like that of a lifeboat in that we have essentially unlimited population pressure on limited natural resources. In other words, Hardin is a neo-Malthusian: he believes that the Earth has a finite 'carrying capacity' that cannot indefinitely support population growth. The lifeboat analogy is his way of explaining why he believes we will have to make some hard choices about access to and distribution of natural resources. In Hardin's analogy, the rich countries in the boat (with their low fertility rate) should not help the poor countries outside the boat because such help only supports their unsustainable population growth, ultimately dooming all (sinking the lifeboat).

6 pts 3. (a) What does the phrase *sustainable agriculture* mean?

Sustainable agriculture consists of practices that meet immediate and long-term food production needs while protecting other natural resources. For example, sustainable agriculture practices control soil erosion, deforestation, aquifer depletion, and pollution.

12 pts (b) According to Wes Jackson, what are the best ways to achieve sustainable agriculture?

Jackson points out that farms are ecosystems, and that *they should imitate natural ecosystems* if they are to be stable and successful. According to Jackson, farm ecosystems — particularly large 'industrial' monoculture operations — are vastly simplified compared to natural ones. He quotes Sir Albert Howard to describe the characteristics of natural ecosystems that should be applied to farming:

> The main characteristic of Nature's farming can therefore be summed up in a few words. Mother earth never attempts to farm without livestock; she always raises mixed crops; great pains are taken to preserve the soil and prevent erosion; the mixed vegetable and animal wastes are converted into humus; there is no waste; the processes of growth and the processes of decay balance one another; ample provision is made to maintain large reserves of fertility; the greatest care is taken to store the rainfall; both plants and animals are left to protect themselves against disease.

Jackson's work concentrates on investigating the feasibility of substituting perennials in a polyculture for the more typical annuals in a monoculture. His organization (the Land Institute) believes that perennial polyculture agriculture will provide:

- better nutrient recycling, reducing or eliminating the need for fertilizer;
- better resistance to pests and diseases, reducing or eliminating the need for chemical pesticides; and
- more control of soil erosion due to the overwintering of the perennials.

12 pts 4. What do you think Julian Simon's views were on the concept of 'sustainable development?' Elaborate in some detail.

Sustainable development was defined by the Brundtland Commision as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' Sustainability mavens like Paul Ehrlich and Lester Brown warn that we compromise the ability of natural resources to support future generations if we exceed the 'carrying capacity' of the Earth. But Simon thought that the carrying capacity of the Earth was essentially infinite because the ingenuity of humans will be able to find equivalent or superior substitutes for any resource that is in danger of being exhausted. In other words, natural resources are unlimited because of our inventiveness, which is the 'ultimate resource.'

That being the case, Simon argued, there is no need to worry unduly about conserving natural resources because they are, for all intents and purposes, inexhaustible. Future generations will be fine with whatever resources we leave them because we will also leave them the technology to use those resources to meet their needs. Simon cites as support the fact that the standards of living, as well as the price of natural resources, have been falling throughout human history.

10 pts 5. The two most common commercial GM crops are Bt crops and herbicide resistant crops. Their supporters claim that widespread use of these crops will result in a decrease of overall pesticide use. What is their reasoning?

The bacterium *Bacillus thuringiensis* produces insecticidal proteins called Bt toxins. These have been used to spray crops (even those carrying the 'organic' label) for decades. Corn and cotton crops have been genetically modified to produce these toxins internally, reducing the need for external application through spraying. Some insecticide must still be used because Bt toxins do not kill all insects.

Herbicide resistant crops, HRCs, have been genetically engineered to be more tolerant of the herbicides used to kill weeds that compete with crops for available nutrients, soil and sunlight. Although the presence of this resistance would seem to encourage greater use of herbicides, the idea is that a single heavy dose early in the season with a broad-spectrum herbicide will kill off the non-resistant weeds. Averaged over the entire growing season, less herbicide would need to be used to control weeds, and by the time the crops are harvested the herbicide has disappeared.

12 pts 6. Paul Ehrlich said that there are 'birth rate' and 'death rate' solutions to the problem of population growth. Explain in some detail what he meant.

The global population growth rate is the difference between the birth rate and the death rate. So long as the birth rate exceeds the death rate, population will increase. According to Ehrlich, any nonzero growth rate is not sustainable, because the carrying capacity of the Earth is some finite number that will eventually be reached. This means that eventually the population *will* stabilize, one way or another. The 'birth rate solution' is to stabilize population level by decreasing the birth rate so that it equals the death rate. The 'death rate solution' is to do nothing, allowing the population to exceed (overshoot) the carrying capacity, at which point the death rate will increase as a result of factors such as famine, war, lack of potable water, and/or disease. These are the symptoms that would manifest once the carrying capacity is exceeded, causing the population to drop back to a sustainable level.

10 pts 7. What is the difference between *economically* and *technically* recoverable oil?

Not all the oil in an oilfield can be recovered. As the oil field empties, it gets progressively more difficult to extract the remainder. This fact eats into the profit margin because it takes more energy and more sophisticated technology to extract the oil. Eventually a point is reached at which the remaining oil cannot be extracted by existing technology; this limit sets the amount of oil that is 'technically recoverable.' Typically the recovery factor — the fraction of oil that is technically recoverable — is about 50% of the total amount of oil in the field.

Before this limit is reached, however, a point will be reached at which it will no longer be profitable to recover and sell the oil. In other words, the cost of extraction, refining, storing and shipping the oil will exceed the benefit of selling the oil. This point sets the limit of the amount of oil that is 'economically recoverable.'

It is worth noting that both of these limits can change somewhat as the price of oil increases, increasing the profitability of oil extraction, and as extraction technologies are invented or become more efficient and/or cheaper.

14 pts 8. According to Lappè and Collins, why hasn't the Green Revolution ended world hunger? Explain in a little detail.

The Green Revolution was the development of high-yield crops; Lappé and Collins called them *high response varieties* (HRVs) because the crops generally require more intense use of fertilizers, irrigation and pesticides in order to give these high yields. Global food production has indeed increased dramatically since the Green Revolution, although it is worth noting that *per capita* food production has been falling for over a decade.

Lappé and Collins cite the following reasons for a failure of the new crops to end world hunger:

- the HRVs displaced local crops that had evolved to grow in difficult conditions, lowering local crop yield
- family farms, often a primary means of support for many in developing countries, have become less and less profitable due to increasing land prices and increased prices of the technology to support the HRVs. For families that do not own their own land, the business practices of the increasingly city-dwelling, absentee landlords have further decreased their earnings.
- the increased mechanization of agriculture has decreased the demand for field hands
- the industrialization of agriculture may be accompanied with increased food production, but that food may not go to those who need it most. Coupling the increased price of food with the decreased earning power of the rural poor means less food and more hunger.

Ultimately, Lappé and Collins do not view world hunger (solely) as a problem of production. Indeed, Indeed, many countries with widespread famine are net *exporters* of food. Agricultural industry is not in the business of ending hunger but of making a profit. So the problem is a political and social one; as Lappé and Collins state, 'there can be no separation between technical innovation and social change.'