# Solutions to Tutorial Questions

**Chapter 10 Renewables**

**10.1 Why are marine fisheries over-fished?**

They are overfished because they are either common property resources, where a defined number of fishers share the resource, or open access where any fisher can enter the fishery. Both these forms of shared ownership are inefficient. In the case of common property resources a Nash equilibrium, where each firm maximizes its profit subject to the fishing effort of the other firms results in a lower total profit than ownership by a single firm or a regulated solution. In the case of open access the profit tends towards zero as positive profits induce more firms to enter the fishery.

**10.2 How is open access different from general common property in fisheries?**

Common property is where a defined number of fishers are licensed or allowed by convention to share the resource. Open access is where any fisher can enter the fishery.

**10.3 Are effort restrictions an effective long term fishery policy?**

In the short-run effort restrictions can achieve a similar catch and fishing effort as a catch quota. In the long term, say two to three years into the future, fishers invest in new boats and technologies that get around the effort restrictions. This type of behavior in fishery economics is called ‘capital stuffing’ (excessive investment) and leading to ‘effort creep’ where effort within existing effort restrictions becomes more effective at catching fish. In the long term effort restrictions breakdown and overfishing emerges as a problem. This tends to lead to more stringent and complex effort restrictions over time. This is inefficient as it artificially increases the cost of fishing and reduces the profitability of the fishery compared to a catch quota.

**10.5 What are the main drivers of forest loss in Brazil and the Ivory Coast?**

The reasons for deforestation vary from country to country and vary within countries. In Brazil the pattern of deforestation approximately follows a Frontier Model - Rudel and Roper (1997) where investment opens up areas of forest for timber extraction and clearing for large farms. This may be followed by a phase where smaller farmers follow into the region and start to clear along corridors of land alongside roads. The Frontier model is related to income and earnings from exports related to deforestation (mainly beef from farms on cleared land and timber). The Ivory Coast, unlike Brazil, has lost most of its forest. Further deforestation is due to subsistence agriculture encroaching on remaining forest areas. Rudel and Roper (1997) call this process the Immiserization Model. Deforestation is driven by poverty and a fall in income from other sectors of the economy that reduces household income and increases reliance on subsistence agriculture.

Rudel, T., and Roper, J. (1997). ‘The paths to rain forest destruction: cross-national patterns of tropical deforestation’, World Development 25: 53–65.

**10.6 When should a natural forest never be cleared?**

A forest should not be cleared when the change in timber value per time period (MV) plus the flow of non-timber values (G) as a share of the total timber value (V), that is (MV+G)/V exceeds the discount rate (r) for all time periods. This means that the social return from retaining trees exceeds the opportunity costs of a dollar tied up in timber the discount rate. See Figure 2 for a fuller analysis.

**10.7 Why should the developed countries consider compensating the poor nations to stop deforestation?**

If natural forests are viewed as a global public good that benefits all humanity by storing biodiversity and carbon. There is a case for developed countries, who benefit from the public goods provided by forest conservation, contributing to the opportunity costs of not developing borne by the developing countries that host the forests. Such a payment has the potential to be globally optimal and is reflected in the REDD+ United Nations Framework Convention on Climate Change (UNFCCC) mechanism where developing countries, such as Costa Rica, are paid for conserving rainforest

**10.8 Why are non-timber forest products often not taken into account when governments decide to allocate logging concessions?**

First non-timber use values such as firewood, hunting and gathering and non-use values such as biodiversity, regulation of water catchments and soil fertility do not have a clear market value. Therefore they are often not taken into account by governments when making logging decisions. Second benefits from logging often go to timber companies who have no incentive to take account of the loss in income suffered by households that benefit from the forest as a source of food, shelter, and firewood.

**10.9 Is there any evidence for an environmental Kuznets curve for forestry?**

There is evidence from cross country studies by Rudel and Roper (1997) and Ehrhardt-Matinez et al.(2002) to support the presence of an Environmental Kuznets Curve. In particular Ehrhardt-Matinez et al.(2002) find an inverse relationship between the rate of deforestation and income per capita in a country: this is the main prediction of the Environmental Kuznets Curve.

Ehrhardt-Martinez, K., Crenshaw, E. M.,Jenkins, J. C. (2002). Deforestation and the Environmental Kuznets Curve: A Cross-National Investigation of Intervening Mechanisms, Social Science Quarterly, 83, 226-43