# Solutions to Tutorial Questions

**Chapter 8 Conflicts and cooperation**

**Why are the predictions of the prisoner’s dilemma so important to natural resource management?**

The prisoner’s dilemma predicts that without regulation or some form of cooperation between fishers or grazers sharing a common property resource, the resource will be over-exploited. Over-exploitation in economics means that profits from the resource are not maximized due to excessive fishing effort or excessive grazing. The reason that this arises is that in a prisoner’s dilemma, firms that share the fishery have an incentive to collectively engage in more fishing effort than a single profit-maximizing firm. Often where common property resources are overexploited it arises because resource exploiters compete for the resource rather than cooperate.

**Why is Elinor Ostrom more optimistic about the world’s commons than Garrett Hardin?**

Quoting Garret Harding (1968):

“As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.

1) The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.

2) The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision making herdsman is only a fraction of -1.

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another.... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit-in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all.“ (p1244)

In other words Hardin has an overwhelmingly pessimistic view of humankind’s ability to manage common property resources. He predicts that the workings of the prisoner’s dilemma leads inevitably not only to economic inefficiency but also to resource degradation on a global scale. Thus the use of the commons is viewed as a tragedy where humanity remorselessly over-exploits and degrades the resource.

In contrast a more optimistic and nuanced empirical analysis of the outcomes that could arise in commons is provided by Ostrom and her co-workers:

“Sustainably managing common natural resources, such as fisheries, water, and forests, is essential for our long term survival. Many analysts have assumed, however, that people will maximize short term self-benefits—for example, by cutting as much firewood as they can sell and warned that this behavior will inevitably produce a “tragedy of the commons”, such as a stripped forest that no longer produces wood for anyone. But in laboratory simulations of such social dilemmas, the outcome is not always tragedy. Instead, a basic finding is that humans do not universally maximize short-term self-benefits, and can cooperate to produce shared, long-term benefits.”(Vollan and Ostrom (2010), p923)

Ostrom analyses a large number of real common property resources to show that for many of these resources the ‘appropriators’ (firms and households) are able to develop sophisticated systems of resource sharing that depend on communication, self-regulation, and complex informal rules that ensure that the resource is used at a high level of efficiency. There is a danger that government intervention may actually be counterproductive as the appropriators cease self-regulation and may start to devote effort to cheating on government regulation.

References

Hardin, G. (1968). The Tragedy of the Commons, Science, 162, 1243-248.

Vollan, B. and Ostrom, E. (2010). Cooperation and the Commons, Science, 330, 923-924.

**Why was the Montreal Protocol successful in reducing CFCs, whilst the Kyoto Protocol has failed to get all the countries to agree?**

The Montreal Protocol agreements over the reduction in substances which damage the stratospheric ozone layer represent a relatively successful international environmental agreement in terms of achieving its objective of phasing out the use of CFCs. The reasons for this are that the environmental costs were potentially large and shared by all countries and the costs, due to the development of new products, were declining through time. The use of side payments also facilitated the inclusion of poorer countries. This outcome contrasts with the current state of disagreement over the right course of action in relation to climate change (see Chapter 12). Currently climate agreements do not include any trade sanctions. The stability of the Montreal Protocol is strengthened by the threat of trade sanctions if countries are found to be non-compliant or refuse to sign the protocol. This has been an effective deterrent against free-riding.

**With reference to co-operative game theory, why might coalitions of all firms be unstable in relation to producer groups sharing a common property natural resource?**

Cooperative game theory tells us that coalitions of firms that share a resource will voluntarily cooperate in a coalition only if they are better off in the coalition than they are outside the coalition. This turns out to be a stringent requirement for coalition stability as it implies first that there are overall gains to cooperation and that the share of these gains is greater than any firm could earn individually and in other coalitions. Coalitions are unstable if any of these conditions are not met.