The Tragedy of the Commons Revisited:
A Note on Plagues and Pestilences and the Canada Goose

by

Mark Sproule-Jones
and
Andrew Balahura

McMaster University
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DRAFT ONLY: Comments and suggestions for improvement are welcomed.

Introduction

In recent years, the theory of common property or common pools (CPR) has proved to be a seminal way of explaining the sustainability of resources. Initially developed as a way of understanding the over-exploitation of specific natural resources that were or are under threat of extinction, the theory is now applied to other resources held in common and to which access is not limited. Common pools are defined as resources that are subject to the subtraction rule whereby any withdrawal reduces the availability of that resource for others, but to which exclusion is costly.

CPR Theory initially centred around the so-called "Tragedy of the Commons" in which the self interest of harvesters to withdraw or catch resources dominated each of their long run interests to sustain the resource (Hardin, 1968). Buffalo, or whales, or many fish stocks fell into this category. It was often reasoned that since the resource was owned by no-one, there were no rules to limit access and entry, and harvesters faced "prisoners' dilemma" situations in which if they limited harvesting, this would only facilitate greater rewards for the other harvesters. A decade or so ago, this explanation was found in practice to have only limited empirical confirmation. Many examples were found in which communities of harvesters had worked out rules to limit access and withdrawals (see, especially, Ostrom, 1990). These examples include century old sustainable resources, like Swiss alpine meadows or Japanese forests. However the basic logic of CPR theory remained in place to cover situations where rules of access were not in place.

In the more recent past, the CPR theory has been extended to cover situations where no access at all has occurred. An example are shops in Moscow, where the rules of privatization make it possible for every utility and occupant to grant approval prior to a store being opened (Heller, 1998). The resource is "preserved" from any use at all. This theory is symmetrical, but the opposite of the traditional theory (Buchanan and Yoon, 2000).

We wish to raise a different and we think new wrinkle to CPR theory. We wish to extend the logic to resources that people/potential harvesters regard as having negative value, but from which withdrawals are not possible. There are rules that prevent people from eliminating common pool bads of opposed to goods and the stock of the resource can actually increase in these commons' situations. Our case in point is the resource of Canada geese which have become an urban, non-migratory pest or plague in many North American sites. We look at experience in the Canadian province of Ontario, specifically on the shores of Lake Ontario. It is a legal offence for the public to reduce or otherwise cull the population of Canada geese, and through natural fertility the numbers of resident geese have grown to the point that they reduce or eliminate shorelines from other valued activities. We suspect there are other urban pests and plagues in similar situations currently or in the past; examples could include the Parisian dog, the Los Angeles rat, the Toronto raccoon, or even influenza viruses.

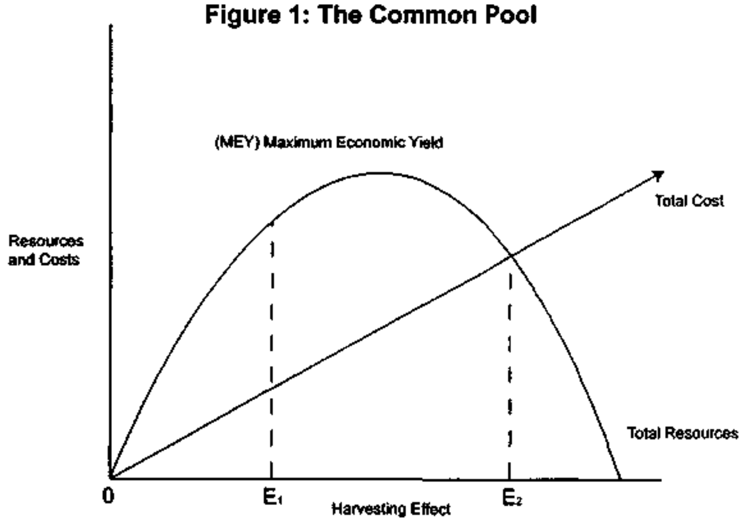
We will describe the problem in Southern Ontario and the solutions ultimately worked out to accommodate the common pool. First we will outline the theoretical extension before we examine the empirical case. We show how the non-market values associated with a non-renewable resource like the Canada geese can gradually be reduced and outweighed by the negative consequences of population increases. We also show how government authorities have continued to restrict culling and harvesting despite supportive evidence, including public opinion. We conclude that the classic tragedy of the commons has an inverse logic whereby limits to harvesting create incentives for the growth of pestilences and plagues particularly in urban areas where carrying capacities appear large.

The Economics Revisited

The basic economics of a common pool renewable resource, that has a market value when harvested, was first described in a seminal article on fisheries by Scott Gorden (1954). Without limits on fishing effort by any individual fisher, each will have an incentive to expand harvesting beyond the point at which economic rents are maximized. Not only will rents be dissipated but the harvest may exceed the sustainability of the resource over time.

In figure 1, rents are maximized at the level of harvesting effort E_1, but the positive returns for extra harvesting effort will induce new or existing fishiers to extend fishing effort to E_2 where all resource rents are competed away. The marginal revenue from fishing will equal the marginal cost at the point of maximum economic yield. This point is exceeded without constraints in harvesting effort.

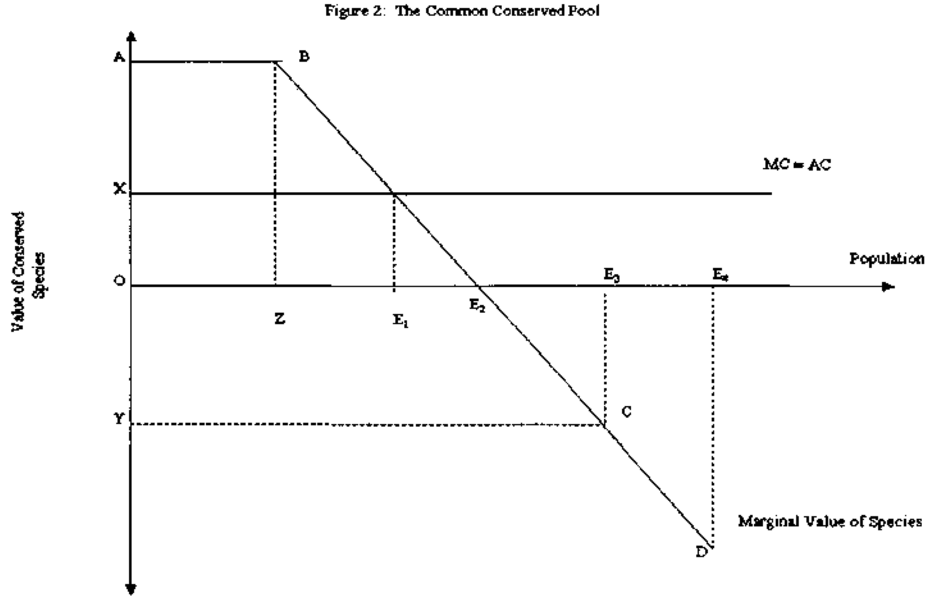
Figure 1: The Common Pool



This theory focusses on renewable resources where the resource has a positive market value and on the incentives for overharvesting when no or few rules exist to limit effort either from individual or community or government ownership.

Now consider the renewable resource that has no real market value, but is positively valued in a non-market way for its sheer existence value as another living species or for its aesthetic value as a wild animal or plant. In this case, harvesting remains at 0 even though it might be most valuable to cull the species at point E, in Figure 1. Given rules against harvesting and conserving the resource, then the economic rent will be frozen. Over time, the resource will increase to its "natural" carrying capacity. These dynamics are illustrated and expanded in Figure 2 in which the economics of a conserved species in a non-harvesting regime is discussed.

Figure 2: The Common Conserved Pool



The X axis now measures the population of the species (resource) in question rather than the harvesting effort. The Y axis measures the value of the species (resource) as expressed in non-market terms.

From 0 to Z, the species is highly valued for its relatively rare existence values as well as its aesthetic value. After a certain population size, the familiarity with the species breeds a decline in its value until at E_2, it loses all value. At E_3 the total positive value of the species equals the total negative value, and not until E_4 is there an (arbitrarily drawn) carrying capacity which limits the potential negative value of conserving the resource or species.

Assuming that culling the species is costless, conservation authorities will want to limit the population to E_2. Beyond this point, from E_2 to E_3, the species becomes a pest (its marginal value becomes negative). Beyond E_3, say to E_4, the magnitude of the past is such that a plague (where the total value of the species is negative) exists.

Assuming that culling the herd is not costless, one may draw a marginal cost curve MC that intersects the revenue curve for the population size of E_1.

Thus we can see that zero harvesting of the common pool can lead to pestilence and plagues and that some rules need to be devised to encourage harvesters to withdraw species (or renewable resource outputs). Our case shows that the Canadian Wildlife Service would rather tempt fate and create pestitences or plagues than permit entry of others into the harvest for Canadian goose. They have a monopoly over implementation rules for harvesting.

The Case of Canada Goose

The intrinsic and aesthetic value of Canada goose is well known. Kit Howard Breen writes of "the most magnificent animals on the planet... which provide pleasure and enjoyment as they fly in V-formation" (Breen, 1990, 1). They were traditionally harvested by aboriginals and settler populations as they migrated between Canada and the U.S., and like an open access common pool, they were in danger of extinction: "By the late 19th and early 20th centuries excessive hunting and egg poaching had all but destroyed North America's stock of Canada geese" (Nelson, 1919, 74-82).

A result was the Migrating Birds Convention between the U.S. and Canada, with parallel implementing legislation, signed in 1916. The Canadian Wildlife Service (of Environment Canada) and the U.S. Fish and Wildlife Service (of the Department of the Interior) were granted authority to devise regulations to conserve migrating birds, their eggs and their nests.

At the time the legislation was passed, the Canada geese appear to have been exclusively migratory. Mcllwraith in his early work, Birds of Ontario, discusses the bird as only a migrant and does not identify its breeding patterns (Mcllwraith, 1891, 426). Comparable comments were included in Fleming's 1913 work on The Natural History of the Toronto Region and the 1933 work by Saunders and Dale for the Middlesex County of Southern Ontario (Fleming, 1913, 419; Saunders and Dale, 1933,251). However in the 1920's and 1930's over 1000 captive geese of private citizens were released into the Southern Ontario region, and these birds were both domesticated and dependent on humans. The result was occupancy of parks and grasslands and feeding by park users and bird lovers. By 1980, over 83% of Greater Toronto residents felt the geese were a welcome addition to their parks (Fetteroff, 1983, 82). While these data pertain only to Southern Ontario, it appears an experience shared throughout the southern Great Lakes areas.

At this time the population of geese appeared to be in rough approximation to the numbers at which the marginal value of the resource equalled the marginal costs of harvesting (point E_1 in Figure 2).

In Southern Ontario, the bird population began to increase algebraically. Each pair of geese have between 8 to 10 goslings per year over a 10 year period. Consequently Ontario's geese population increased to 100,000 in 1977,200,000 in 1987, and 400,000 in 1994, essentially doubling in any one area in 5 or fewer years (City of Mississauga, 1996; interview data). The geese adapted to their environment such that their natural predator, the fox, was deterred from hunting them (Environment Canada, 1993). Meanwhile, some parts of the human/population continued to feed these birds. There seemed to be no recognizable carrying capacity to their population numbers. The birds had become a pest and, in some areas like the City of Mississauga in Southern Ontario, a plague. They had reached points E_3 to E_4 in Figure 2.

The consequences of an expanding population of geese now included the cleanliness of parks, the safety of children in parks (from attacks), the safety of adults from slipping on bird droppings, the soiling of playgrounds and the harvesting by geese of the grass from entire sports fields (Mississauga, 1997, Reports 1 and 2).

In these circumstance, the obvious response of the two federal governments would have been to permit extensive hunting and culling of excess non-migrating populations, excess in this case being a population target of between E, and E_3 in Figure 2. A 1998 survey of residents in the one Southern Ontario City of Mississauga found that 80% of the population believed that excessive goose excrement was a very serious or serious problem, a big change from only a few years prior (North, 2000). However, while the U.S. authorities moved to permit each state to develop and implement a wildlife plan for the geese population, the Canadian government agency responsible for permitting harvesting found itself unable to relax its permitting process in part because of the lobbying of bird lovers such as the Animal Alliance or (in Mississauga) the Mississauga Wildlife Society. An option to cull the population and supply the meat to local food banks was rejected ostensibly on cost-effective grounds (City of Mississauga, 1997, Report 3). Instead the Canadian Wildlife Service continued its process of issuing annual permits for egg oiling and relocation, and local governments responded with largely ineffectual methods of modifying turf vegetation, using noise makers and constructing barriers and fences. Both federal and local governments seem to believe that educating the population about and fining the public for feeding the geese population is the best long run strategy of dealing with pestilence and plagues. An optimal population seems increasingly unlikely.

Conclusion

This brief article demonstrates that the tragedy of the commons has an inverted feature to its basic logic. For particular renewable resources, constraints on harvesting will create incentives to expand the resource without necessarily reaching natural carrying capacity constraints. The resource will expand beyond optimal limits desired by the human population as a whole into sizes that may be considered at first pestilence (where marginal values of the population are negative) and to plagues (where total values of the population are negative). Clearly Garrett Hardin identified one side of the commons question and its possible tragic consequences. We have identified its inverse and the consequences may be no less tragic.

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