Numeracy Nugget #2 – Tragedy of the Commons, Etc.

George Rebane, Ph.D.

Garrett Hardin, the late professor emeritus at UC Santa Barbara, was an ecologist and world-class thinker. His long list of original ideas and writings, worth googling up on a quiet evening, pricked many sacred sentiments of the right and left. Hardin was much concerned with population growth and the kinds of decisions required in a world with too many people – kind of like the decisions we are pondering here in Nevada County. 'The Tragedy of the Commons', first published in 1968, is perhaps the best-known from his rich legacy.

In one version the theory is introduced in terms of ten farmers whose cows graze on a commons or public pasture. Each farmer had ten cows whose milk provided him with a major part of his income. The hundred cows filled the carrying capacity of the commons in that the grass was able to grow just fast enough to keep the 100 cows well fed. Then the spontaneous addition of one new cow by a farmer leads to a runaway addition of more cows as the other farmers seek the added benefits of a larger herd. But soon all realize that they must keep adding cows just to maintain their declining income as their milk production plummets because the cows no longer get adequate food from the over-grazed commons.

This story illustrates the inevitable fate of any finite resource pool that is 1) held as a commons (belonging to everyone and yet to no one), and 2) under the control of no one accountable. The first one to violate its carrying capacity gets an immediate but temporary incremental reward. But the sticky part is that everyone must now jump on the consumption bandwagon or they will lose their 'fair share' and continue losing the more they hold back. What seals the fate of all valuable commons is that those who hold back, due to altruism or other sensibility, quickly get punished. While it lasts, you have to join in its destruction or you get nothing while you watch as the commons gets destroyed. Such has been and is our pragmatic morality toward all commons.

Hardin taught us that we are all surrounded by many kinds of commons – the air we breathe, the river we drink from, the roads we drive on, the industry we sue, and even the cookie jar on the kitchen counter. Many years ago my wife Jo Ann, who baked up a weeks' worth of cookies every Sunday evening for the kids' lunches, figured out why the big jar was empty when the kids went to school Wednesday morning. The jar was a commons. Dividing the cookies into plastic bags with names on them suddenly made the cookies last all week. We had eliminated the commons and substituted personal responsibility – what a concept! (Perhaps later we'll look at Hardin's illuminating insights on how responsibility really works in a society.)

The commons theory itself can be modeled mathematically to show how competing 'agents', who try to maximize some form of what scientists and economists call utility, destroy a commons. For many people the obvious fix is to still put the resource into commons (or public) ownership and then manage it with whatever coercive means needed to conserve the commons. This solution is a little tricky to apply with folks who have gotten used to the land of the free and the home of the brave. And most people who keep up with world news now know that it's near impossible to preserve any commons under dictatorships (witness the late USSR) or in poor countries (witness most of Africa). At this point we might ask what commons do we have here in Nevada County and how will their fate affect the quality of our lives.

Last time in NN#1 I promised the formulas for calculating actual gain/loss of buying power for an investment with annual return *I%* while inflation increased *F%*. At the year's end the annual gain/loss is $A = (I - F)/(1 + F)$. And after N years at these rates the total gain/loss of buying power is $A_N = (1 + I)^N/(1 + F)^N - 1$. Be sure to convert percentages to decimals in these formulas.

For today's numeracy nugget we have a problem with a disarmingly simple solution that illustrates the kinds of message that enable the internet and

other networks to operate smoothly. Ten men are to be executed at dawn by a warlord who on the previous evening decides to show some mercy. He tells them that in the morning they will all be buried up to their necks spaced about two yards apart in a staggered line. All will face in the same direction so that every man can see all the heads in front of him but none behind. After commanding absolute silence upon pain of death, a random selection of black and white caps will be placed on their heads starting at the front of the line so that each man can only see the caps of all the men in front of him but not his own. The warlord will then put his pistol to the head of the last man in line (who can see all the other hats), and ask him to say only the word 'White' or 'Black' to indicate the color of his own hat. If he's right he lives, else a quick sayonara. With these rules in hand the men are then left together for the night to consider their fate. It's clear to all that if each just guesses at his hat color then half of them can expect to survive. Suddenly one of them (from Nevada County) yells 'Eureka!' and describes to all a method (or algorithm) for you to discover which guarantees that at least nine and perhaps all ten will survive the ordeal. Happy noodling till next time!