



Garrett Hardin (1968) described how when multiple individuals are exploiting a common resource, and acting only in their own best interest, will inevitably overexploit the resource. This is referred to as ‘the tragedy of the commons’. The overexploitation stems from the fact that the individual gains *all* of the benefit (e.g. profit) from exploitation of the common resource, while the cost of the exploitation is *shared* among all the individuals using the resources. The implications of this phenomenon are wide-reaching, informing biological conservation efforts, natural resource management, and economics, to name a few. ‘The commons’ being exploited could be as small as a patch of land, a large tract of government owned land, or the global environment as a whole. Thus, avoiding the inevitable overexploitation could involve anything from a handshake agreement to international law.

This model illustrates the concept in a common pasture on which four farmers are grazing cattle, and collecting milk each day. Each farmer can graze as many cattle as they want on the pasture, but the overall number of cattle that can be sustained in peak condition in the pasture is limited (there is only so much grass to go around). As farmers add cattle beyond the grazing limit of the pasture, the amount of milk given per cow will go down. If too many cows are put onto the pasture, the cows will starve and die.

The model provides a number of controls that can be manipulated, numerical data, and a graphical depiction of the pasture (Figure 1).

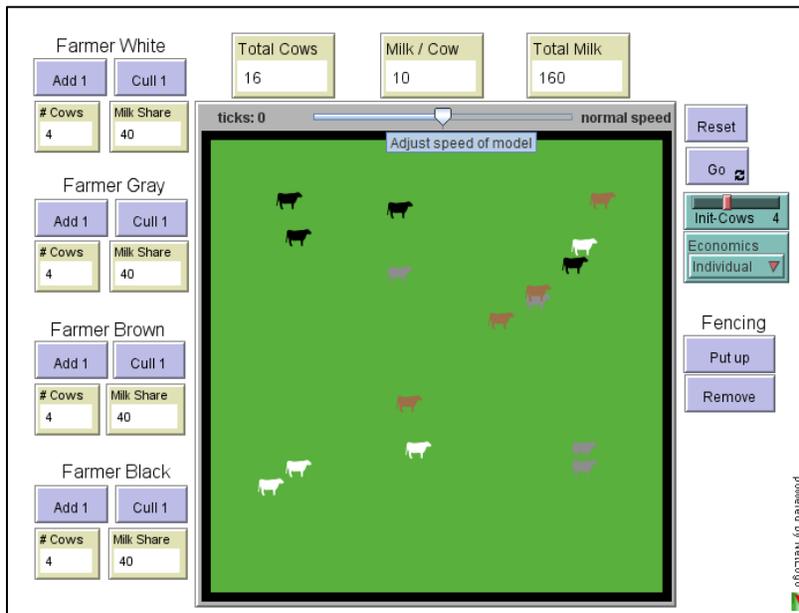


Figure 1: The user interface of The Tragedy of the Commons Model. This model depicts a pasture which is shared by four dairy farmers, and the farmers must decide how many cows to place on the land to maximize their milk production.

- Each farmer has the option of adding [Add 1] or removing [Cull 1] cows at any time, with the color of the farmer's cows matching their names (e.g. farmer Gray has gray cows).
- The model can be reset to the selected parameters by clicking [Reset], and the cows can be put in motion by clicking [Go]. The speed of the cow's movement can be adjusted to a bovine pace with the slider above the pasture depiction.
- The model reports the number of cows each farmer has in the pasture and their share of the total milk production in gallons.
- Above the graphical depiction, can be read the total number of cows in the pasture [Total Cows], the amount of milk produced per cow per day [Milk/Cow], and the total milk production of all the cows in the pasture per day [Total Milk].
- The slider [Init-Cows] determines how many cows each farmer will have in the pasture when the model is opened, or if [Reset] is pushed.
- The [Economics] dropdown menu selects if the farmer keeps all the milk produced by their own cows (Individual), or if the total milk produced is shared equally among the farmers (Cooperative).
- The pasture can be divided into four equal parcels with fencing by clicking [Put up], at which point each farmer's cows are moved to separate sub-pastures limiting the amount of grass they have to graze. Thus, the milk production for each farmer responds to how many cows they have on their own section of pasture. The fencing can be taken down by clicking [Remove].

References

Hardin, G. 1968. The tragedy of the commons. Science 162: 1243-1248

The model can be found online on the Virtual Biology Lab website:

<http://virtualbiologylab.org/TragedyCommons.htm>