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Irina Kareva, Benjamin Morin and Georgy Karev*, karev@ncbi.nlm.nih.gov. *Preventing the tragedy of the commons through punishment of over-consumers and encouragement of under-consumers.*

The conditions that can lead to the tragedy of the commons, i.e., to the situation when a shared resource is depleted due to overexploitation, can be reformulated as a game of prisoner's dilemma: while preserving the common resource is in the best interest of the group as a whole, over-consumption is in the interest of each particular individual at any given point in time. One way to try and prevent the tragedy of the commons is through infliction of punishment for over-consumption, thus selecting against over-consumers. The effectiveness of various punishment functions in an evolving consumer-resource system is evaluated within a framework of an infinitely-dimensional system of ODEs. Conditions leading to the possibility of sustainable coexistence with the common resource for a subset of cases are identified analytically using adaptive dynamics; the effects of punishment on heterogeneous populations with different initial composition are evaluated using the Reduction theorem for replicator equations. (Received September 21, 2011)