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Optimal time dependent sampling for invasive species management.

Previous studies on the optimal detection of invasive species have recommended less intense sampling protocols than what is often deployed in the field. However, these suggestions are largely based on the analysis of static strategies, ones that do not change over the course of time, and therefore can underestimate sampling effort during the earliest portion of the management period. Using optimal control theory to minimize the total cost of damage and management, we find that the best detection strategies are characterized by intense early sampling, followed by a sharp decline in sampling effort towards an equilibrium value that should be maintained consistently over the rest of the management period. For such a strategy to greatly reduce costs over the best constant strategies, three conditions must be met: (1) the pest's local spread rate must be much larger than the rate of introduction and establishment from an outside source, (2) the cost of sampling is far cheaper than the cost of local outbreaks and (3) sampling is effective. When these conditions do not hold, time static sampling protocols can provide reasonably cost effective control. (Received September 02, 2014)