

On the economic benefit of predicting rodent outbreaks in agricultural systems

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Abstract

In variable environments there can be a clear need to predict outbreaks of agricultural rodent pests. Rodent populations often increase rapidly in response to periods of unusually high rainfall, presumably due to an increase in the quantity of food available to them or its quality, such that relationships between the likelihood of an outbreak and past rainfall form the basis of a forecasting method. A discrete probability model for the annual costs associated with an outbreaking species is used to quantify the economic value, if any, of such forecasts. Assuming C to represent the cost of pre-emptive control, Q the total economic loss caused by an outbreak, and z the proportion of losses during an outbreak that are mitigated by preemptive control then a general criterion is that the relationship between outbreaks and rainfall must discriminate between years in which the likelihood of an outbreak is above C/Qz , and years in which it is not. The expression C/Qz represents the cost of control relative to the economic benefit of implementing control in an outbreak year. It is critical because its inverse, Qz/C , is the number of years a producer can invest in control and still break even provided there is an outbreak in one of those years. This criterion applies to any forecasting method, regardless of the number of predictive factors or whether the relationships between outbreak likelihood and the predictive factors are monotonic. The critical likelihood is calculated for three agricultural systems with outbreaking rodent species; the house mouse (*Mus domesticus*) in south-eastern Australia, the multimammate mouse (*Mastomys natalensis*) in Tanzania and Brandt's voles (*Microtus brandti*) in Inner Mongolia. For the first two of these systems the relationship between outbreaks and rainfall can be associated with economic benefit, but for the last system the relationship with rainfall is such that the highest predicted likelihood is below C/Qz .

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