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The role of silica defences in driving vole population cycles

As with many small mammals, vole populations are commonly characterized by multi-year cycles of abundance. Uncertainty remains over the mechanisms underpinning these population cycles. One possible factor is the interaction between the voles and their food.

Some grass species mount a delayed defensive response to grazing by increasing their rate of uptake and deposition of silica. This induced response occurs when herbivore populations are high. Elevated silica levels make the grass a lower quality food for herbivores, leading to a reduction in herbivore performance. When grazing impact is lessened, silica defences relax and plant quality recovers. This inducible defence may have an important role in driving cycles in some populations of voles.

We have developed a delay differential equation model to represent this herbivore-plant interaction. This has been parameterized using empirical data from a particular system, namely field voles (Microtus agrestis) and their principal food species, the grass Deschampsia caespitosa, in Kielder Forest in Northern England. I will discuss the predictions of this model, and their implications for the hypothesis that silica defences shape the dynamics of cyclic vole populations.