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Kéfi, S., Dakos, V., Scheffer, M., Van Nes, E. H. and Rietkerk, M. 2013. Early warning signals also precede non-catastrophic transitions. – Oikos 122: 641–648.

Appendix A1

1) Model equilibria

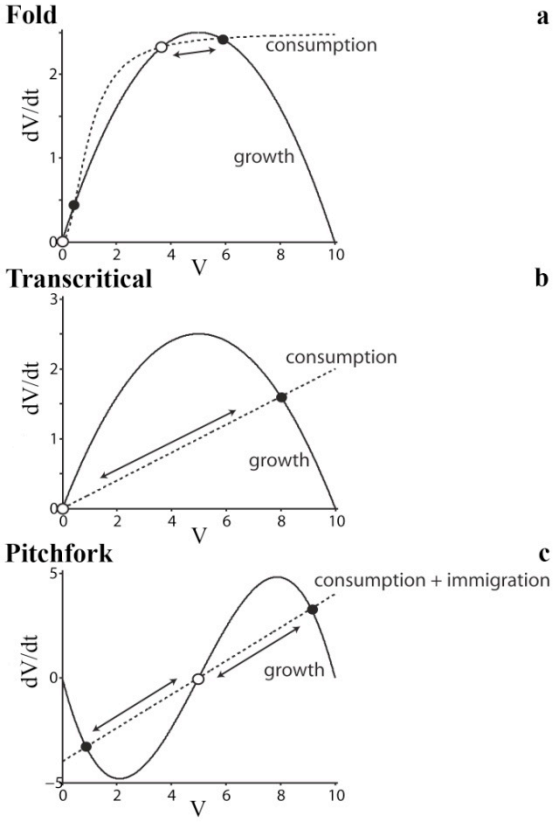

Figure A1. Behavior of the fold, transcritical and pitchfork models. See Table 1 for equations. The panels display the vegetation biomass growth rate dV/dt as a function of V. Solid lines display the growth rate of the vegetation (i.e. the positive term of the equation in Table 1) and dashed line display the vegetation loss rate (i.e. the negative term of the equation in Table 1). The intersection points of these two lines correspond to potential equilibria.

2) More about the pitchfork bifurcation

In the model of Noy-Meir (1975) and May (1977), in addition to a linear functional response, we also assume that there is an Allee effect as well as a constant immigration of biomass. At low growth rates the resource is sustained just at the Allee threshold. However a gradual increase of its growth leads to an increase in resource biomass. In this case, there is a continuous transition at which two new symmetric equilibria appear (Fig. A1). This type of transitions is less likely to be observed in nature than the other ones presented in this paper because it heavily relies on symmetry in the equations.

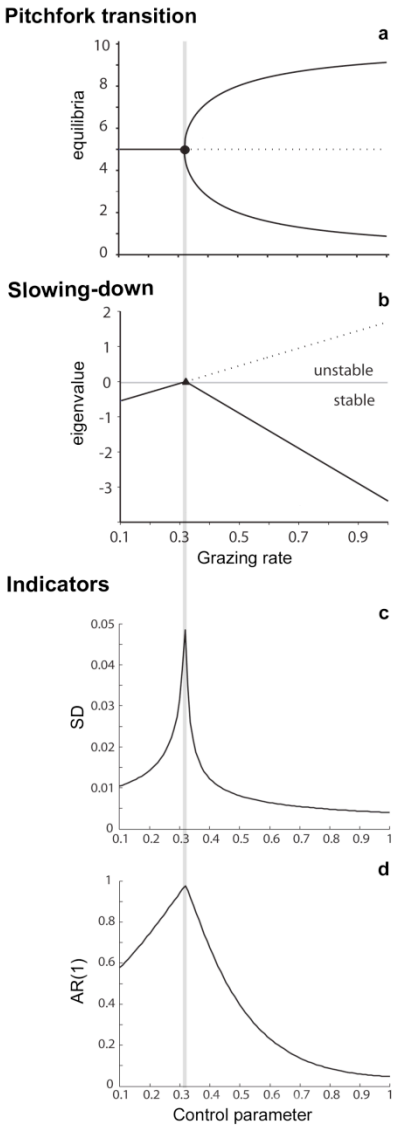

Figure A2. Behavior of the indicators before a pitchfork bifurcation. First row: model equilibria

depending on the control parameter (*c*; see Table 1 for parameter definition), second row: dominant eigenvalue of the system, third row: standard deviation, fourth row: autocorrelation at lag one.