We are interested in the effect of a pulse perturbation on the abundance of a species and on the total abundance of a community of species. Let us take a simple case in which species have a locally stable equilibrium abundance (for species ). Let us also take a case in which species do not interact, such that the equilibrium abundance of species is equal to the carrying capacity of that species . Since carrying capacity can be linearly related to intrinsic growth rate (Vasseur & McCann 2020, and assuming all else is equal (e.g., no variation in the strength of density dependence), then in this simple case we find that the equilibrium abundance is linearly related to intrinsic growth rate .

Now consider a pulse perturbation with two environmental states, e.g., two temperatures, one temperature being the control temperature and the other being the treatment temperature . Temperature may affect growth rate, such that there is a difference in growth rate between control and treatment temperatures . Since equilibrium abundance and growth rate are linearly related, the effect of the pulse perturbation on equilibrium abundance will be proportional to its effect on growth rate .

Hence, a large effect on the growth rate of a species will translate into a large effect on population size, i.e., a large effect of the pulse perturbation on growth rate will lead to low population stability with respect to the pulse (e.g., when population stability is measured by resistance, or a related measure, e.g., cumulative deviation from control dynamics as is used later in our study). And a small effect of the pulse perturbation on growth rate will lead to high population stability.

What about community stability? Let us consider the stability of total abundance. How will total abundance be affected by the pulse perturbation. Total abundance at equilibrium is , and the difference in total abundance between the control and treatment is . Therefore, the effect of the pulse perturbation on total abundance is linearly related to the sum of the effect of the pulse perturbation on the growth rates .

This tells us when that the community will have greatest stability to the pulse perturbation (i.e., lowest effect of the pulse on total abundance) when the effects on species growth rates sums to zero . In contrast, if most of the species are negatively affected by the perturbation, we expected a lower stability (negative effect on total abundance). And when most of the species are positively affected by the perturbation, we expected a lower stability (positive effect on total abundance). (See Figure *Simple Expectation* in the PowerPoint of the same name.)

How does this relate to response traits and response diversity? The effect of the pulse perturbation on a species’ growth rate can be thought of as a species response trait (Ross et al 2023). Since we expect that the sum of these response traits will explain a very high proportion of the variation in community stability (in principle all of it), then a measure of response diversity (such as one of those proposed in Ross et al 2023) will either explain the same amount of variation in community stability (i.e., all of it) or less. And they will only explain the same if the same amount if they are perfectly correlated with the sum of the response traits.