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Generic dynamics of nonlinear systems with embedded predator-prey feedback cycles

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Many nonlinear systems with embedded predator-prey interactions have the order-preserving monotonicity with respect to a rank-k cone (with $k > 1$). We show such systems enjoy the limit-set trichotomy properties, and the restricted semiflows on a given ω-set of precompact semiorbit can be characterized by a Lipschitz-continuous flow on the k-dimensional Euclidean space. In the case where $k = 2$, we obtain the generic Poincaré–Bendixson theorem, and the generic periodicity of high-dimensional epidemic systems with non-standard nonlinear instance functions. The talk is based on a series of studies in collaboration with Lirui Feng and Yi Wang, some of these results have been reported in SIAM J. Math. Anal. (2017), J. Differential equations (2021) and SIAM J. Applied Math. (2022), and many more to come.