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David J Wollkind, Richard A Cangelosi, Bonni J Dichone* (dichone@gonzaga.edu) and **Mitchell G David.** *A Stuart-Watson Nonlinear Stability Analysis of a Generalized Matkowsky Heat Equation.*

The Matkowsky model heat equation originally analyzed through terms of third-order to illustrate his two-time method of nonlinear stability theory is extended through terms of fifth-order for a generalized source. This formulation can be interpreted as a model population interaction-dispersion equation as well. When analyzed by the Stuart-Watson method of nonlinear stability theory, it is shown that under the proper conditions the two subcritical cases behave in exactly the same manner as the two supercritical ones unlike the outcome for the truncated system. Further there also exists a region of metastability allowing for the possibility of population outbreaks. These results are then used to offer an explanation for the occurrence of isolated vegetative patches and sparse homogeneous distributions in the relevant ecological parameter range where there is subcriticality for a plant-groundwater model system as opposed to periodic rhombic patterns and dense homogeneous distributions occurring in its supercritical regime. (Received September 21, 2017)