MODEL AS A TOOL OF COGNITION. II.
ONE MORE CAUTIONARY TALE ABOUT MATRICES AND GRAPHS

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The former 'CAUTIONARY TALE' (announced from the tribune of MCE-2014), was telling about a series of matrix models for reed grass population dynamics on forest clear-cuts, where those perennial grasses actively colonized open spaces due to their high rates of vegetative propagation. The ontogeny of reed grasses is studied comprehensively in the Russian school of geobotany, while the matrix models – whenever calibrated reliably on field data – enable us to estimate quantitatively the measure of local population fitness to the environment as the dominant eigenvalue ($\lambda_1 > 0$) of the model nonnegative matrix [1].

The traditional data-mining technique was reduced to annual censuses of all individual plants on permanent sample plots in terms of their age-stage statuses to be determined by the morphology of aboveground parts [1]. As a result, the *life cycle graph* was implemented in the form of a digraph on a finite 2D lattice of all observable statuses. The technique enabled the calculation of ontogenetic transition rates, whereas the status-specific reproduction rates did remain uncertain. The uncertainty was eliminated by accepting the λ_1 *maximization hypothesis* and solving the ensuing constraint maximization problem [2]; to test the hypothesis, a series of field experiments were undertaken by a new technique (digging up the plots to identify the mother–daughter links among the grass rhizomes) [3].

Dictated by the modelling needs, the new experiment design has revealed a new phenomenon in the reed grass ontogeny (offspring entering the generative stage while missing the virginal one); it also resulted in the modelling cases (still absent in the literature) where the λ_1 fails as an adequate measure of fitness and needs to be refined [4].

References

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