



# Understanding Complex Ecosystem Dynamics: A Systems and Engineering Perspective

*William S. Yackinous*

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*Understanding Complex Ecosystem Dynamics: A Systems and Engineering Perspective* takes a fresh, interdisciplinary perspective on complex system dynamics, beginning with a discussion of relevant systems and engineering skills and practices, including an explanation of the systems approach and its major elements. From this perspective, the author formulates an ecosystem dynamics functionality-based framework to guide ecological investigations.

Next, because complex system theory (across many subject matter areas) is crucial to the work of this book, relevant network theory, nonlinear dynamics theory, cellular automata theory, and roughness (fractal) theory is covered in some detail. This material serves as an important resource as the book proceeds. In the context of all of the foregoing discussion and investigation, a view of the characteristics of ecological network dynamics is constructed. This view, in turn, is the basis for the central hypothesis of the book, i.e., ecological networks are ever-changing networks with propagation dynamics that are punctuated, local-to-global, and perhaps most importantly *fractal*. To analyze and fully test this hypothesis, an innovative ecological network dynamics model is defined, designed, and developed. The modeling approach, which seeks to emulate features of real-world ecological networks, does not make *a priori* assumptions about ecological network dynamics, but rather lets the dynamics develop as the model simulation runs. Model analysis results corroborate the central hypothesis. Additional important insights and principles are suggested by the model analysis results and by the other supporting investigations of this book – and can serve as a basis for going-forward complex system dynamics research, not only for ecological systems but for complex systems in general.

- Provides a fresh interdisciplinary perspective, offers a broad integrated development, and contains many new ideas
- Clearly explains the elements of the systems approach and applies them throughout the book
- Takes on the challenging and open issues of complex system network dynamics
- Develops and utilizes a new, innovative ecosystem dynamics modeling approach
- Contains over 135 graphic illustrations to help the reader visualize and understand important concepts



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