

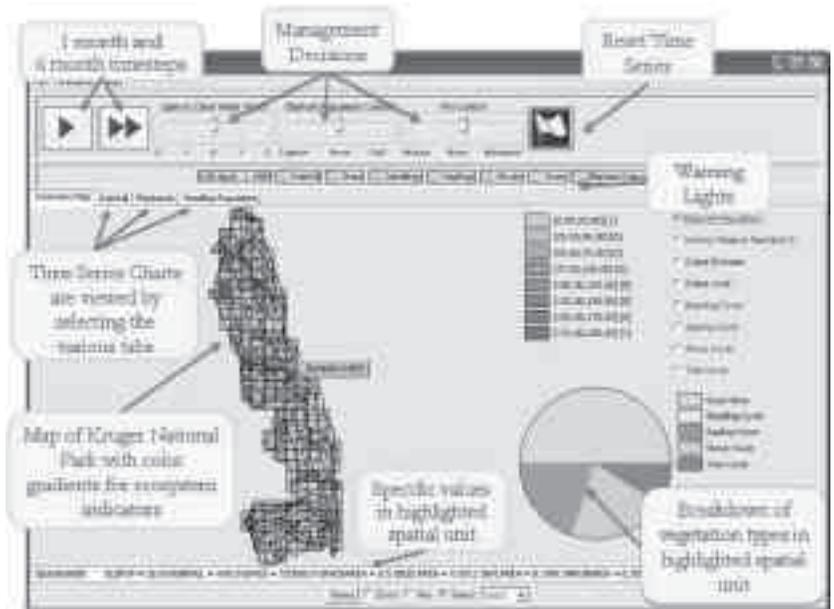
## Taming Wicked Problems: Ecosystem Modeling for Adaptive Management of Rivers and Elephants

**GREG KIKER**

All of my projects in southern Africa deal with complex environmental challenges that integrate people, their decision processes and the tools needed to help them to explore and address these dilemmas.

The first project involves modeling the ecological effects of water withdrawals from the Crocodile River, which forms the southern boundary of the Kruger National Park in South Africa. Nathan Wangusi, my Ph.D student, received a Rotary Fellowship to spend one year in South Africa to develop his ecological models in cooperation with the University of KwaZulu-Natal, water management authorities and the Kruger National Park. Nathan is working with my Questions and Decisions (QnD) model system to provide computer game-style tools to integrate ecosystem processes, management, economics and socio-political factors into a user-friendly model framework. We are developing a QnD game version to integrate hydrological simulations from a South African model (Acru2000) with ecological classifications to simulate the effects of water abstractions from the Crocodile River.

The second project is the development of an elephant and vegetation model for ecological management of elephant population control scenarios within savanna ecosystems. Elephant and vegetation management in southern Africa has been described as a “wicked” problem where solutions defy simplistic notions and problem contexts continually shift with evolving expectations and adaptive learning. While the southern African scientific community has assembled a strong, multi-disciplinary information base for elephant biology and management, full integration of these diverse sectors for analysis and management has not yet been realized. An integral part of adaptive management is the use of computational models to inform and adjust management responses to thresholds of potential concern (TPCs). My QnD:EleSim model utilizes elephant/vegetation algorithms developed by ecologists to simulate landscape-scale tree-grass competition and growth with agent-based implementation of spatially-



explicit, elephant populations.

Additional research activities in southern Africa have established research links with the Harry Oppenheimer Okavango Research Centre (HOORC) at the University of Botswana through the NSF-IGERT program (Adaptive Management: Wise Use of Water, Wetlands & Watersheds). Anna Cathey, a Ph.D student whose committee I co-chair, is conducting research into water resource modeling and uncertainty analysis in the Okavango River Basin and Delta. We were able to leverage this initial collaboration into a larger grant from NASA to explore climate change and its effects on land use in the greater Okavango, Kwandu and Zambezi River basins. This new research grant headed by Jane Southworth in the Dept. of Geography is providing research support for two additional Masters students (Sanjiv Jagtap and Gloria Perez-Falcon) to study

vegetation modeling and land use change in the tri-basin area. This research uses both simple (QnD) and complex (SAVANNA) models to explore ecosystem resilience and uncertainty.



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