STANFORD UNIVERSITY
DEPARTMENT OF STATISTICS

DEPARTMENTAL SEMINAR

4:15 p.m., Tuesday, February 13, 2007
Sequoia Hall Room 200
(Cookies at 3:45 in 1st Floor Lounge)

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How to Estimate a Political-Ecological Process Model So That It Can Be Used to Manage an Ecosystem

A predictive understanding of the political processes that produce a particular sequence of ecosystem management decisions would provide a tool to gauge how much social change would be needed to make an ecosystem sustainable. To this end, a stochastic, temporal model of how political processes influence and are influenced by ecosystem processes is being developed. This model is realized in a set of interacting Influence Diagrams (Bayes Nets with Decision nodes) that each model the decision making of political groups in countries that affect an ecosystem. These group models also interact with a model of the affected ecosystem.

As an example, a model has been constructed for the management of the endangered Cheetah (Acinonyx jubatus) across Kenya, Tanzania, and Uganda. Here, the ecosystem model is a system of stochastic differential equations that model cheetah population dynamics. A data set has been collected that consists of political actions by groups in these countries along with cheetah counts by political region.

A frequentist approach to fitting the political-ecological model to this data is described. For group models, the idea is to minimize the Hellinger distance between Influence Diagram multivariate distributions defined by a set of point parameter values (to represent substantive theory constraints), and the fitted model while also maximizing the agreement of the fitted models' decisions with those observed. For the cheetah count model, the idea is to also minimize the Hellinger distance to a theory-based set of parameter values but to also minimize the Hellinger distance between the fitted model, and a nonparametric estimate of the cheetah count's density function.