Summer Program on Mathematical Modeling

- Our Mathematical Modeling course (MATH 485/585) combines formal lectures with computer laboratories and simulations of dynamical systems and models.

- Undergraduates work in teams on modeling projects, under the supervision of graduate or post-graduate mentors.

- Projects are based on modeling papers published in the research literature (Nature, Science, PNAS, Physical Review, Physica A, Journal of Mathematical Biology, etc).

- Each undergraduate team writes a midterm and a final report, and gives oral presentations of its work.
- Students taking the course for graduate credit work on their own modeling problems.
- At the end of the semester, students present their projects in a poster session held in a public venue.
- Posters from the past two years are available online at http://math.arizona.edu/~lega/485-585/mh.html

- *Mathematical epidemiology: modeling the spread of the West Nile virus,* based on *An epidemiological model for West Nile virus: invasion analysis and control applications,* by M.J. Wonham, T. de-Camino-Beck, and M.A. Lewis, Proc. R. Soc. London **B 271**, 1471-2954 (2004).

- *An alternative language learning model*, based on *Win-stay, lose-shift in language learning from peers,* by F.A. Matsen and M.A. Nowak, Proc. Natl. Acad. Sci. **101**, 18053-18057 (2004).

- *Analyzing the Red Grouse - T. tenuis System*, based on *Prevention of Population Cycles by Parasite Removal*, by P.J. Hudson, A.P. Dobson, and D. Newborn, Science **282**, 2256 - 2258 (1998).

- *Resistance to antibiotics,* based on
  A model of antibiotic-resistant bacterial epidemics in hospitals by G.F. Webb, E.M.C. D'Agata, P. Magal and S. Ruan, Proc. Natl. Acad. Sci. **102**, 13343-13348 (2005).

- *Modeling collective behaviors of organisms*, based on
  Effective leadership and decision-making in animal groups on the move, by I.D. Couzin, J. Krause, N.R. Franks and S.A. Levin, *Nature* **433**, 513-516 (2005).

- *Barchan sand dunes*, based on
  Continuum saltation model for sand dunes, by G. Sauermann, K. Kroy, and H.J. Herrmann, Phys. Rev. **E 64**, 31305 (2001).

- Working knowledge of
  - Calculus
  - Introductory differential equations
  - Introductory linear algebra

Questions for the audience

- Are there some modeling themes you would like to see included in the summer program?
- Will your students be able to participate?
- Are there skills that you would like your students to learn during the summer program (for instance, PowerPoint, MATLAB, LaTeX, how to write a resume)?
- Would it be useful to have MATLAB-based applets that would help undergraduates learn or review basic mathematics skills needed in a mathematical modeling course?
- Would you consider transporting some of these projects to your own institution, either as Research Experiences for Undergraduates, or as part of a mathematical modeling course?