

Consortium on Law and Values in Health, Environment & the Life Sciences

Student Proposal Cover Page

Applicant Information

Applicant Name: Margaret Kosmala Date: 1/4/08
Project Title: Effect of Climate Change on Wildebeest-Human Relations
Department: Ecology, Evolution, Behavior College: Biological Sciences
Home address: 162 Bedford St. SE Apt. 2 City & State: Minneapolis, MN Zip: 55414
Faculty advisor name: Craig Packer Email: packer@umn.edu Not applicable
Dept. Head's name: Claudia Neuhauser Dept. Head's email: neuha001@umn.edu
Dean's name: Robert Elde Dean's email: elde@umn.edu

How did you hear about this funding opportunity? Direct email

Funding

Amount of funding requested: \$7000

Funding justification: [a clear statement of what you will use the funds for without going into budget details]

These funds will support research to develop a model to predict wildebeest birthing areas in the Serengeti in response to climate change. These areas are a source of conflict between the wildlife and pastoralists whose cattle contract diseases from the newborn wildebeest calves. The funds will offset the cost of traveling to Tanzania to examine wildebeest birthing areas and assess the extent of current conflict, and they will provide support during initial design and development of the computer model.

Approvals

Check all appropriate approvals required for your proposal. Approvals must be obtained prior to receipt of funding. If you have applied for approval but have not yet received it, indicate that below.

- IRB Date submitted: _____ Number: _____
 IACUC Date submitted: _____ Number: _____
 Other Explain: Tanzanian research permits are in process.

For Use by the Consortium Office

- The proposal is 1000 words or less excluding budget, biographies, references and citations.
The proposal includes a work plan with a specific timeline using months or quarters to identify work to be done and completion dates.
 The proposal includes a 1-2 paragraph biography of the applicant and all co-investigators.
The budget form is complete including the funds sought for this project, other pending applications for this project, and the amount/source of matching or other funds.
 The applicant's faculty advisor is copied on the application email. Professional students w/o advisors check NA.
 All necessary approvals are pending or received.

Effect of Climate Change on Wildebeest-Human Relations

Historically, wildlife conservation has focused on setting aside protected land. However, as climate changes, wildlife alter their movement patterns and may leave protected areas. Increasing human populations outside of conservation areas combined with altered wildlife movements create conflicts of interest between people and wildlife. Addressing such conflicts is increasingly important to successful conservation.

In the Serengeti ecosystem of Tanzania, a million wildebeest (*Connochaetes taurinus*) migrate through both protected and human-inhabited areas. At the start of the wet season, wildebeest migrate to the plains where they give birth on grazing land shared with Maasai pastoralists¹. Not only do wildebeest compete with Maasai cattle for grazing access, but newborn wildebeest calves also expose the cattle to malignant catarrhal fever, a fatal disease for which there is no vaccine². Extreme weather in recent years has changed calving locations, and a growing human population has led to increased human demand for fences to exclude wildebeest from grazing areas and for conversion of grassland to agriculture². It is unknown how the wildebeest migration will respond to increasingly variable weather and to human disturbances in this vital shared grazing area. To fill this gap, I will develop a predictive model of the effects of climate change and land use decisions on migrating wildebeest populations and the resulting effect on local human populations.

In building the model, I will begin by focusing on the ecological drivers of the wildebeest migration: spatial and temporal variability in rainfall³ and soil nutrient gradients⁴, with minor effects from the distribution of surface water, fire, topography, and predators⁵. Data for all these parameters are readily available: rain gauges throughout the Serengeti have provided rainfall information for decades; soil nutrients have been studied; and remote sensing has yielded spatial data about surface water, vegetation, and fire; wildebeest population dynamics and mortality rates have been studied. As a member of the Serengeti research consortium, I have access to all the data necessary for such a synthesis. I will procure early aerial surveys of wildebeest movements and recent wildebeest data from censuses and GPS collaring. I will also explore the use of Normalized Difference Vegetation Index (NDVI) satellite data to directly locate wildebeest and their monthly movements. This novel use of NDVI satellite data to directly detect wildlife has not yet been attempted and could become an important new tool for research and conservation.

The output of my model will be spatially explicit predictions of the numbers and locations of wildebeest throughout the migration. From this output, I will map the areas in which wildebeest give birth and can transmit MCF.

I will model the impact of climate change on the wildebeest migration and the flexibility of their response, emphasizing years of abnormal rainfall and comparing predicted calving locations with locations observed in the past. I will test the impact of human disturbances by removing different parts of the landscape, thus simulating reduced habitat when fences are built or grasslands are converted to agriculture. I can then compare the effects of human disturbance at different locations along the migratory route on the size of the wildebeest population and the location of their calving grounds.

This project will require expertise from multiple disciplines. The model will require ecological and climatic knowledge of the Serengeti in order to properly parameterize it. In addition, I will rely on my background in computer science and mathematics to apply the best algorithms to design and build the model. Finally, I will consult with an applied economist to

determine how to incorporate human decision-making in such a way that model outputs can be used to advise land use and conservation policy.

Although wildlife movements around the world are expected to change in response to climate change, there exist very few models that predict exactly how those movements will change. This project will combine ecological data, innovative technological approaches, and economic decision-making to predict such movements and proactively address conservation issues. The results will assist in mitigating the conflict between wildebeest and pastoralists in the Serengeti and will also provide insight into the general effect of climate change on wildlife movements and the resulting conservation implications.

Work Plan

June-July 2008: Travel to Tanzania to examine wildebeest birthing areas and assess the extent of current conflict between wildebeest and Maasai pastoralists. I will begin in villages in the eastern part of the Serengeti in which wildebeest have been continuously described as problematic⁶. I will also use my trip to build relationships with officials of the Ngorongoro Conservation Area Authority (NCAA) to determine how best to use my research results to inform policy decisions about land use and conservation.

August-December 2008: Build and validate the spatially explicit computer model, using the extensive data sets of the Serengeti Consortium, and explore new techniques for locating birthing wildebeest.

January-February 2009: Use the model to test climate scenarios and human alterations to the Serengeti landscape, such as fencing off part of the historical wildebeest range.

March-April 2009: Analyze implications of changed wildebeest movements on land use policy and conservation. Discuss implications with NCAA officials and get feedback.

May-June 2009: Write up research results and transfer the modeling technology to the NCAA.

References

- (1) Maddock, L. in *Serengeti* (University of Chicago Press, Chicago, 1979).
- (2) Bedelian, C., M.S. dissertation, University of Edinburgh, 2004.
- (3) Boone, R., Thirgood, S., and Hopcraft, J., *Ecology* **87**, 1987 (2006).
- (4) Holdo, R., Holt, R., Coughenour, M., and Ritchie, M., *Journal of Ecology* **95**, 115 (2007).
- (5) Fryxell, J., in *Serengeti II* (University of Chicago Press, Chicago, 1995).
- (6) Fosbrooke, H. *Ngorongoro: The Eighth Wonder* (Survival Books, London, 1972).

Margaret Kosmala is a first-year doctoral student in Ecology, Evolution, and Behavior at the University of Minnesota. She is interested in studying the complex dynamics between natural systems and humans in order to inform public policy and conservation efforts. She studied computer science as an undergraduate at Brown University, where she conducted interdisciplinary research while working on her senior thesis project, involving both medical and computer science components. After college, she worked in telecommunications research for the United States government, developing presentation, teaching, and writing skills. As she learned more about politics, international issues, and land-use policy, she decided to switch fields and apply her technology skills to matters of ecological sustainability.

Since arriving at the University of Minnesota in September, she has attended a conference of Serengeti researchers at which she met officials with the Tanzanian Wildlife Research Institute and Serengeti National Park, as well as researchers from across North America and Europe. She was accepted into the two-month Tropical Biology field course offered by the Organization for Tropical Studies in Costa Rica and procured funding for the course through the Ecology, Evolution, and Behavior's Sigerfoos Fellowship.

Consortium on Law and Values in Health, Environment the Life Sciences

Budget for Student Proposals

Project Title: **Effect of Climate Change on Wildebeest-Human Relations**

Instructions: add rows for multiple personnel.

Category	Description & justification	Requested funding	Matching/other funding	
		Amount	Amount	Source
Personnel <i>Explain what hourly wage & fringe are based on-- departmental, community or other rate?</i> Wage based on departmental rate to fund summer support of research project	Salary = 300 hrs x \$21.17 hrly wage Fringe rate What work will this person do? Graduate researcher will design and develop computer model Subtotal	 \$5,000 \$5,000	 \$20,000 \$20,000	Graduate School Fellowship for Sept 2008-May 2009 (secured)
Speaker Honoraria	___ speakers x \$ _____ honorarium	\$0	\$0	
Supplies & Services	List items and explain use.	\$0	\$0	
Equipment <i>Equipment costs are allowable only if the justification clearly shows that the equipment is necessary for the project. Include explanation of what will happen to equipment at completion of project.</i>	Identify and explain use.	\$0	\$0	
Travel <i>Travel costs must include a description of the purpose of the travel, start and stop dates of travel, transportation costs, housing costs, and allowable per diem (use University rates found at http://travel/umn.edu).</i>	Explain. Round-trip airfare to Tanzania: \$2,000 Travel within Tanzania: \$200 Room and Board: \$50 per diem x 30 days (= \$1,500)	\$2,000	\$1,700	Office of International Programs (sought)
	Subtotal research supplies, equipment, travel, other	\$2,000	\$1,700	
TOTAL BUDGET		\$7,000	\$21,700	