

# The Ewaso Water Project: Studying the Linkages between Hydrology, Ecology, and Society

By Dr Lizzie King

With a warm climate, plenty of sunshine, and fairly fertile soils, the resource that most strongly limits the ecological productivity in Laikipia district is **water**. Rainfall patterns govern vegetation dynamics, animal populations, and the welfare of humans who depend on the environment for their livelihoods. On the group ranches in northern Laikipia, the combination of low rainfall, vegetation loss, land degradation, high livestock densities, limited pastoral mobility, insecurity, and poverty create especially large challenges for conservation, development, and sustainability.

Addressing these challenges requires natural and social science research, application of research findings to predict patterns of future change, participatory action to bring about desired future scenarios, and the implementation of policies that support sustainable trajectories. The Water, Savannas, and Society Initiative is a multi-disciplinary research programme sponsored by Princeton University (U.S.A.). The project's first main goal is to conduct scientific research to understand some of the key linkages between hydrology, ecology, and pastoralist societies. Its second goal is to collaborate with other agencies, such as LWF, AWF, and CETRAD, so that research findings can be used to develop appropriate predictions, actions, and policy decisions.

The field research component of the initiative is called the Ewaso Water Project. It is being carried out on three group ranches in northern Laikipia - Koiya, Tiemamut, and Il Motiok - and around Ol Donyiro town in neighbouring Isiolo District and on Mpala Ranch. The research team includes American and Kenyan professors, postdoctoral researchers, doctoral students, and undergraduate students, as well as project coordinators and field technicians from the local communities. The Project is lead by Prof. Daniel Rubenstein, a behavioral ecologist whose long-term research in Kenya has focused on plains zebras and Grevy's zebras, and is managed by postdoctoral researcher Lizzie King, a rangeland and restoration ecologist. The project benefitted from the LWF Community Liaison Officer Joseph Mosiany, who helps coordinate the project's community relations and provides support and supervision for eight of the project's field technicians. Below we outline three of the Ewaso Water Project research components that are currently underway.

## Ecohydrology: Plant-water interactions

The role of water in shaping the ecological landscape is a fundamental question to the Ewaso Water Project. Field studies and computer simulations are combined to understand the feedbacks between rainfall, runoff, soil moisture, and patterns of vegetation at spatial scales ranging from individual shrubs and trees to entire hillslopes and watersheds. Of particular interest are the role trees play in hydrological dynamics. In addition the distribution of soil types, which can strongly impact soil water availability and vegetation at the hillslope scale, are being studied.

Once a basic understanding of these interactions is achieved, the researchers will next seek to incorporate the effects of livestock and wildlife herbivory on ecohydrology feedbacks, because these processes are central issues in rangeland and wildlife management.

## Wildlife and Livestock Movements in Response to Rainfall and Vegetation

The ecohydrology studies described above will give us an indication of how vegetation is expected to change in response to rainfall. The Project also seeks to understand how herbivores, both wildlife and livestock, respond to those vegetation changes. Eight local community members are employed as research technicians, or "scouts," to monitor livestock and wildlife movement. The scouts cover four different 1000-acre zones near their home communities. Each zone spans a gradient from full livestock utilization to livestock restriction. Each week the scouts record: 1) wildlife tracks, dung, and sightings, 2) livestock movements, behaviour, and milk yield, 3) vegetation condition wherever wildlife or livestock are observed, and 4) wildlife and livestock usage of temporary watering points.

The aim is to understand how livestock and wildlife movements respond to vegetation condition, as well as to each other. Furthermore, herbivore distributions also feed back onto vegetation dynamics via areas of higher and lower grazing intensity. Ultimately the goal is to couple this information with rainfall-vegetation linkages from the ecohydrology research, to build a larger knowledge base that can help us predict the consequences of three-way interactions between rainfall, vegetation condition, and herbivore distributions.

This year the project will expand the monitoring

of animal movements, habitat choice and water by placing GPS tracking collars on Grevy's zebras, cattle and goats throughout the study area.

## Grazing Practices, Conservation Areas, and Customary versus Formal Rules

In the communal grazing systems of northern Laikipia, a great deal of herbivore-landscape interactions are determined by pastoralists' decisions. The Project will study decision-making at the individual and community levels on several group ranches, with particular attention to grazing set-asides and conservation areas. By comparing the characteristics of grazing regulation rules (or lack thereof) on different group ranches, the research aims to identify traits of rules and community processes that influence the success of cooperative management efforts.

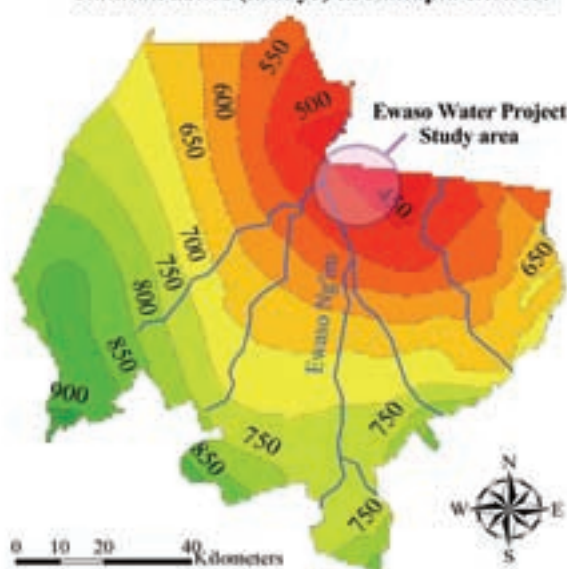
Preliminary observations have shown that the relative influence and popularity of traditional rules versus formal group ranch-based rules shifts seasonally, particularly in response to droughts. By studying this balance, the research will help reveal some of the critical linkages between decision-making, seasonal changes in rainfall and vegetation, and pastoralist welfare.

## Future Objectives: Applying Research Findings to Management and Policy

Much of the research being undertaken builds upon established bodies of research in ecohydrology, rangeland ecology, and pastoralist land use. In addition to furthering these fields, the research here is unique in that all the components are integrated, and are being addressed in a single socio-ecological context. This interdisciplinary approach greatly strengthens the potential applicability of the research findings to community-level land management and broader policy development. As research findings are generated, the results will be shared directly with local communities, and also with organizations that already play development and policy roles in the region. The goal is to thereby maximize the practical impact of the research findings, and to help communities and organizations build informed strategies for improving sustainability.

For more information on the Ewaso Water Project, contact Dan Rubenstein (dir@princeton.edu) or Lizzie King (lizziek@africaonline.co.ke)

Rainfall zones (mm/yr) in Laikipia District



Koiya research scouts, Alex Lester, Trenton Franz, and fundis from Modsan Hardware install rainfall runoff catching equipment and electronic soil moisture probes at Koiya. Runoff is collected inside the walled area, and drains into an underground storage tank where sensors continuously measure the water volume.