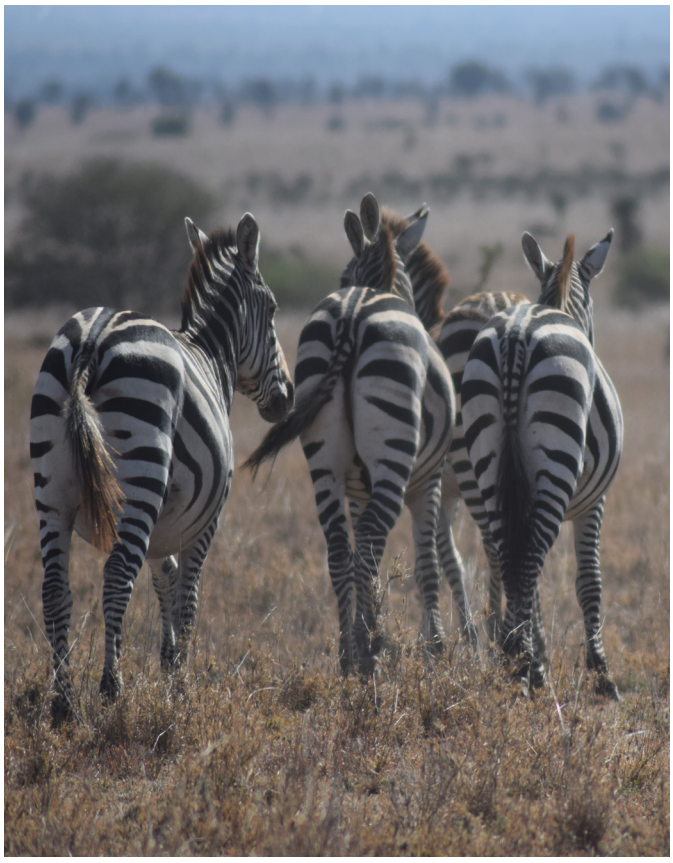
Kapiti plains ranch, farmhouse and research centre

Kapiti ranch

The 13,000-hectare Kapiti plains ranch, located in Machakos county, southern Kenya, was acquired in 1987 by the International Laboratory for Research on Animal Diseases—a predecessor of the International Livestock Research Institute (ILRI)—to produce good-quality, disease-free cattle for research purposes, mainly the improved control of East Coast fever and African animal trypanosomiasis. The ranch is wholly owned by ILRI and registered under Kenya Company Laws as a public limited company. The ranch is home to: 2,500 cattle (mainly of the local Boran breed, with a few Boran-Friesian crossbreds); 1,200 sheep (a mix of Dorper, Kenyan Red Maasai and some crossbreds); and 250 Galla goats native to northern Kenya.

Kapiti ranch is located in Kenya's semi-arid lands (550mm average rainfall) at an altitude of 1,650–1,900m above sea level. The soils of the ranch are mainly black cotton (in the plains) and red cotton (in the ridges); and they support diverse savanna grasses: tussock-forming Themeda (commonly known as kangaroo or red oat grass); Panicum (switchgrass); Chloris (windmill or finger grass); Pennisetum (fountain grass); Cenchrus (African foxtail grass); Setaria (foxtail or bristle grasses); Acacia (whistling thorn); and Balanites trees.

Though the ranch's pasture is usually adequate for its livestock farming, during the dry season water continues to be a major constraint to efficient production. Four boreholes and nine water pans (the latter largely dependent on rainfall) currently supply the ranch with water. A new water pan has just been completed, opening up an area with good-to-excellent pasture.



Kapiti is home to various wildlife, including giraffes, gazelles, antelopes and zebras, as well as predators such as hyenas, lions, cheetahs and leopards. Owing to various infrastructural developments in the neighbourhood (highways, Konza Technocity), Kapiti has become a safe haven for wildlife. This presents unique opportunities to include wildlife in research projects.

Kapiti farmhouse

Kapiti's newly renovated farmhouse is now available for group retreats and workshops and to scientists conducting research on the ranch. Situated in delightful surroundings, the charming traditional-style farmhouse can accommodate up to 18 people in 9 bedrooms, each with its own bathroom. It offers one large and one small meeting room and a fully equipped kitchen. Workshops of more than 18 participants can also be organized.

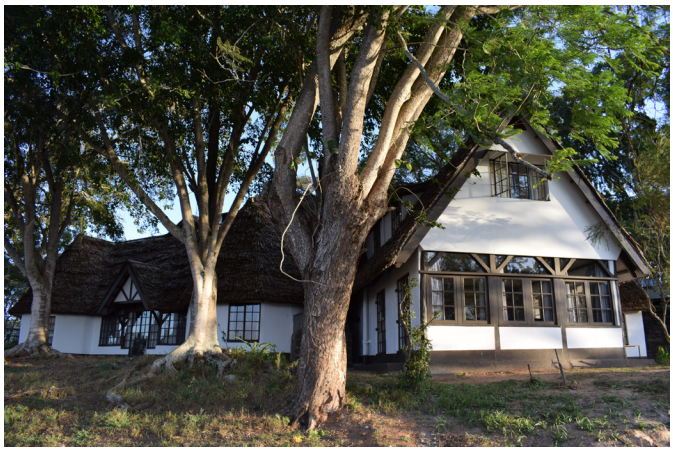
Other infrastructure on the ranch includes offices, spray races, a newly designed cattle crush, two cattle yards, the second with an attached laboratory, as well as various permanent structures and mobile cattle enclosures (bomas) for housing livestock at night. Staff housing is available.

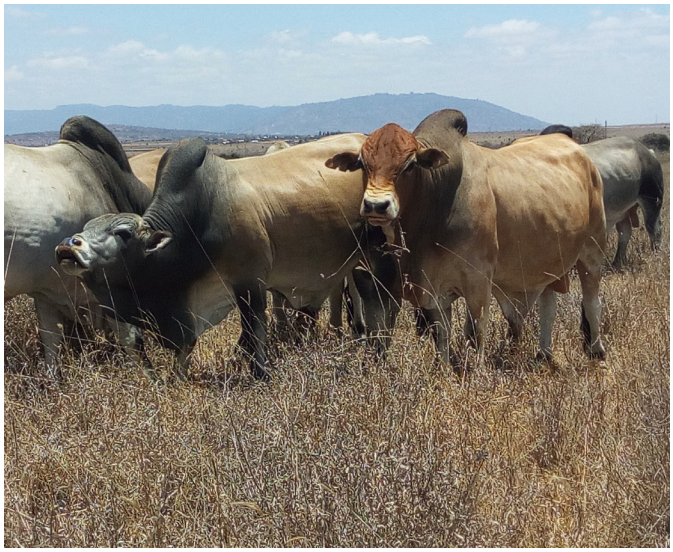
Kapiti research

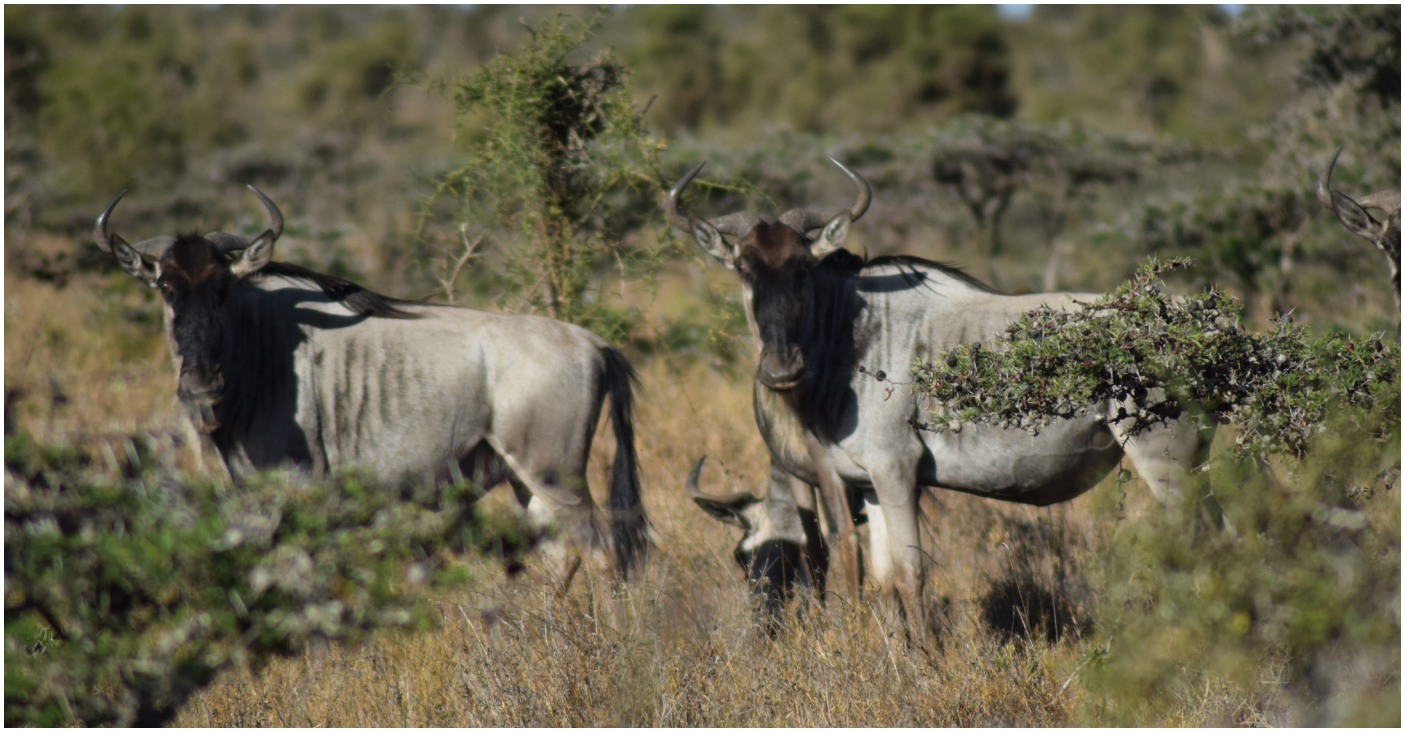
Malignant catarrhal fever vaccination trial

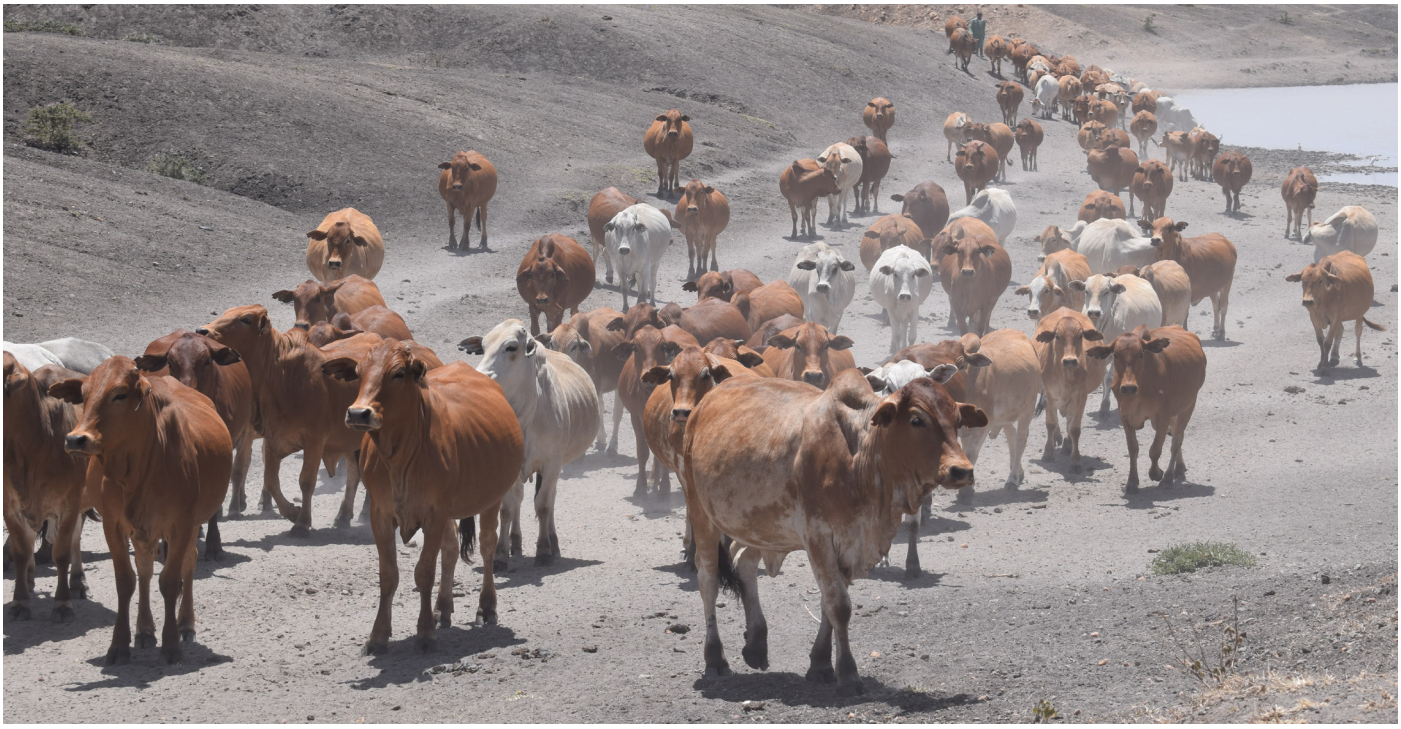
A study of malignant catarrhal fever was developed in response to an outbreak of wildebeest-associated malignant catarrhal fever on Kapiti ranch in 2014. This fatal cattle disease is caused by the alcelaphine herpesvirus 2 which is endemic to wildebeest. It is spread to cattle by parturient wildebeests (giving or about to give birth), the nasal and ocular secretions of young calves, or pastures contaminated by these secretions.

A vaccination trial for malignant catarrhal fever was started at Kapiti ranch in January 2016, in collaboration with the UK Moredun Research Institute and Global Alliance for Livestock Veterinary Medicines (GALVmed). A total number of 146 steers 8–18 months old were selected for the study. Seventy-three animals received the MCF C500 vaccination, while the remainder received a placebo.









There were 25 cases of malignant catarrhal fever in the study herd between May and July 2016, 3 in the vaccinated group and 22 in the unvaccinated group. The difference in the proportion of cases in the vaccinated (4%) and unvaccinated (30%) groups is statistically significant ($p<0.001$). The vaccine efficacy was estimated to be 86% (95% CI 56–96%). These preliminary findings will need to be confirmed in laboratory experiments. Further work is planned to assess the current control methods for malignant catarrhal fever across Kenya and demand for a commercial vaccine.

Genetic variation in responses to foot-and-mouth disease vaccines

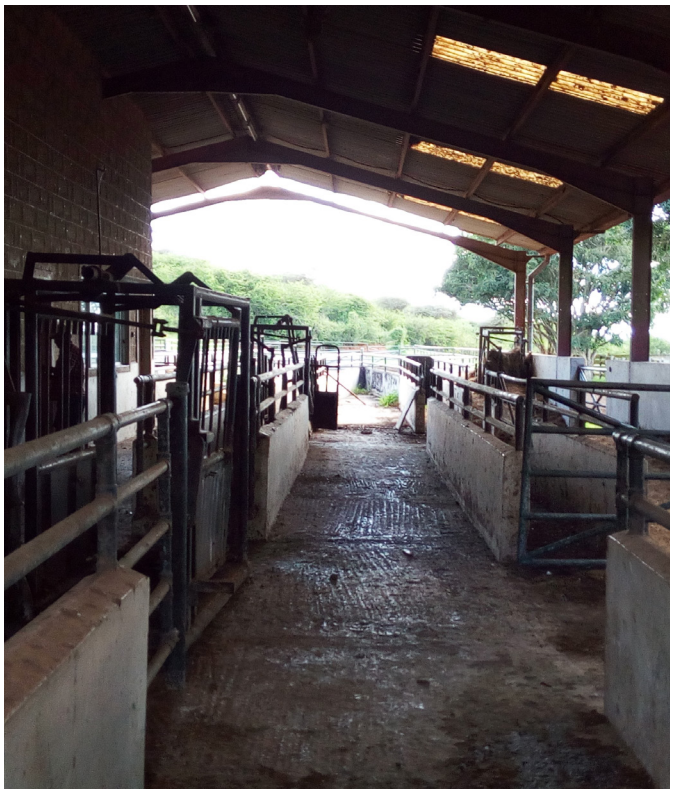
Foot-and-mouth disease (FMD)—a highly contagious disease of cloven-hooved animals—creates an enormous economic burden in many regions where the disease is endemic.

Control of the disease is achieved by vaccination and the control of animal movement. However, the requirement to revaccinate animals at 4–6 month intervals makes it prohibitively expensive for many livestock keepers in low- and middle-income countries.

That responses to vaccination vary among animals may suggest the influence of genotype on their immune responsiveness. Identifying genetic markers, or genes associated with either strong or weak responses, could provide tools with which to select 'good responders' with possibly enhanced disease resistance. This research could both identify animals most resistant to disease and point to new ways to improve the efficacy of vaccination.

The project will select 200 unvaccinated calves at Kapiti Ranch from September 2016–2017. Immune responses to vaccination will be assessed for four months following vaccination. This information will be used to:

- Estimate the variation in antibody response within and between sire groups of Boran cattle to FMD vaccination;
- Develop a mathematical model of the decay of protective antibodies with which scientists estimate the fraction of susceptible animals at a given time after vaccination and how this varies among different sire lines;
- Identify the 'poor' responders and look for genetic markers or sire lines associated with the poor response; and
- Identify MHC I haplotypes associated with 'good' or 'bad' antibody responses.
- Ninety-four calves have been selected so far. All the calves were fitted with radio frequency identification tags and were vaccinated against FMD in September 2016.



Assessing the main nitrogen loss pathways from semi-arid livestock systems in East Africa

This research assesses nitrogen losses from cattle bomas at Kapiti ranch with state-of-the-art micro-meteorological techniques. Gaseous losses of carbon dioxide, methane, nitrous oxide and ammonia from the ecosystem into the atmosphere are being measured continuously, as are nitrogen losses from the soil. This will allow scientists to estimate how much Kapiti's cattle bomas contribute to the ranch's overall nitrogen budget.

Rift Valley fever vaccine immune response trial

Beginning at the end of 2017, in collaboration with The Jenner Institute, University of Oxford, and The Pirbright Institute, a two-year Rift Valley fever vaccine project will test the capacity of Kapiti ranch to serve as a research station for large-scale research projects. A non- inferiority trial will be conducted in both male and female sheep, goats, cattle and camels—the most susceptible species to the Rift Valley fever virus (RVFV) and the major targets of livestock vaccination programs in Africa. Weaned animals aged at least three months and without previous exposure to RVFV will be randomly allocated to vaccination with ChAdOx1- GnGc (n=80 per species), Smithburn vaccine (n=80 per species) or placebo (saline; n=20 per species). The animals will be followed for 12 months after their vaccination, and safety and immunogenicity endpoints assessed. The primary aim of this non-inferiority field trial is to determine the similarities in the proportions of animals mounting a detectable neutralizing antibody response to RVFV following immunization with the ChAdOx1-GnGc and Smithburn vaccines.

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ILRI/Ilona Gluecks

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Selection and crossbreeding to improve sheep productivity and adaptability

The foundation stock of indigenous Red Maasai and Dorper sheep were introduced into Kapiti in 1997 for a comparative study seeking to increase understanding of the relative ability of the two breeds and their crosses to tolerate gastro-intestinal worm infestation, specifically Haemonchus contortus. In 2005, two parallel programs were initiated and continue to date: (1) a selection program seeking to enable improvements in the growth, reproductive performance and hardiness of the Red Maasai sheep; and (2) a Red Maasai–Dorper crossbreeding program producing 50% and 75% Dorper crossbreeds for sale, with the genetically superior young rams selected annually and used in the flock, and subsequently sold to the neigbouring pastoral Maasai herders for breeding. Since 1997, significant amounts of research have been undertaken, including: a) genomic studies to identify the quantitative trait loci for haemonchus tolerance; b) on a participatory definition of breeding objectives; c) estimations of the economic value of live weight, conformation and carcass traits for the two breeds and their crosses; and d) a simulation of the well-adapted and drought-tolerant East African Red Maasai breed and its crosses with the Dorper under different local environments. Data is routinely collected on growth, reproduction, survival performance of these sheep, and studies on the genomic selection of young rams, comparative genomics and related fields are planned in the future.

ILRI thanks all donors that globally support its work through their contributions to the CGIAR system

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