ARS in Africa

Building Trust and Fighting Poverty

The wide, open spaces of Montana might seem to have little in common with the remote villages of South Africa, but an Agricultural Research Service scientist at Miles City, Montana, has found colleagues in South Africa who share his interest in cattle breeding. Together they are working to fight poverty, reduce hunger, and improve beef production in the African nation and in the process, they may improve prospects for cattle breeders around the world.

Mike MacNeil, a geneticist at the USDA-ARS Fort Keogh Livestock and Range Research Laboratory in Miles City, has been developing fruitful relationships in South Africa since 2004 when the ARS Office of International Research Programs approached him with the idea of starting an overseas partnership. MacNeil soon began conversations with Michiel Scholtz, a scientific colleague and cattle researcher at the South African Agricultural Research Council (ARC), and the two set up an informal exchange program. Since then, MacNeil has published five papers and a book chapter with colleagues in South Africa, spoken at several scientific conferences, and forged partnerships that have led to several research collaborations.

These efforts have two goals. The first is to equip South Africa's scientists with the tools necessary to boost the economic prospects of breeders and farmers in remote and underdeveloped areas, where food security issues are paramount. The second goal is to conduct research that will lead to better cattle not only in South Africa, but also in the United States and around the world.

Much of the current research is focused on indigenous Nguni (pronounced en-GOO-nee) cattle, a breed popular among poor and emerging farmers in South Africa because of its fertility, tolerance to harsh conditions, resistance to ticks, and tolerance to tickborne diseases.

"The opportunity to lift emerging farmers out of poverty in South Africa lies with the Nguni. That's what they have in the rural areas, so that's what we are working with. It is very popular and locally adapted to the harsh South African environment, but has never been improved, intensively managed, or properly studied, and as a result, little is really known about it," MacNeil says.

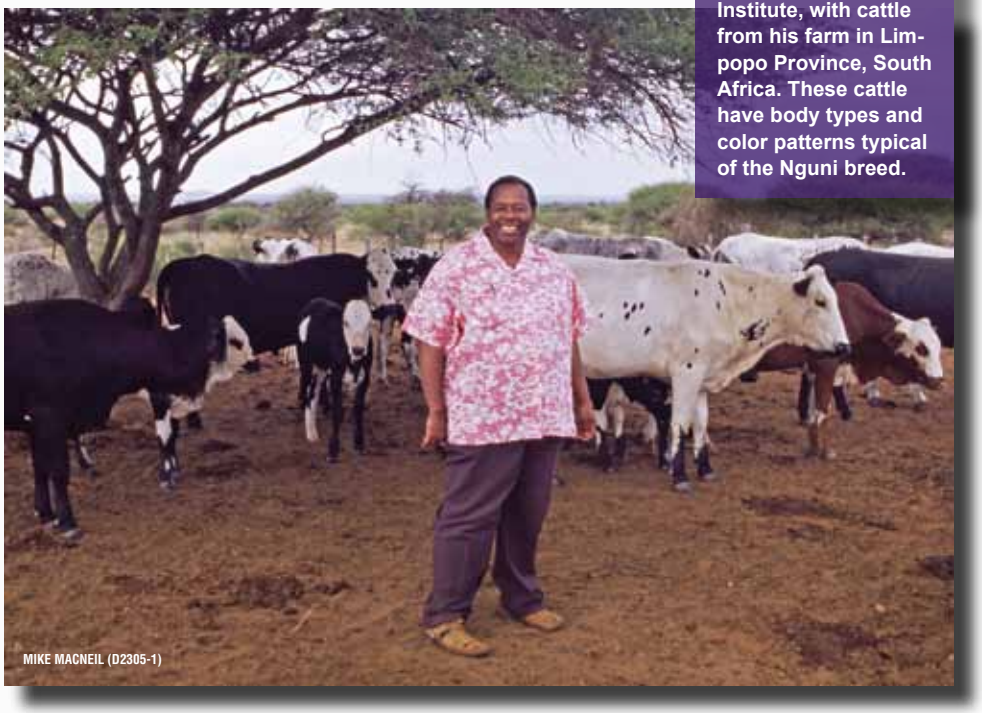
One collaborative study led to a paper that documented a chronic problem in emerging areas: Nguni cattle that are too small and deposit too much fat before reaching market weight, making them undesirable to commercial feedlot operations. The paper, in the *South African Journal of Animal Science,* examined factors that breeders could consider in trying to improve progeny of their Nguni cows by mating them with larger and beefier Angus and Charolais bulls. The resulting crossbred animal ideally would retain the Nguni toughness and adaptability and take on the improved beef aspects of the Angus and Charolais sires. The research built on MacNeil's work over the years at Fort Keogh on development of crossbreeding systems and breeding objectives for U.S. domestic breeds.

Enhancing Beef Production

Olivia Mapholi, an ARC scientist who studied under MacNeil at Fort Keogh while she was earning her master's degree, continues to consult him about her research efforts. She is searching for quantitative trait loci (QTLs)—areas of the cattle genome—that confer the ability to tolerate tickborne diseases. Mapholi is crossing tick-resistant Nguni with tick-susceptible Angus and is looking for genes that confer resistance to ticks. Her research could benefit beef production in any part of the world where ticks are a problem, including the United States.

"If we can find these QTLs, that would be very big because it would not only help breeders in South Africa, but the information could also be used worldwide to reduce losses from ticks," Mapholi says. She has known MacNeil since 2006 and credits him with being instrumental in helping her develop the skills she needed to design the QTL project. "He's been an excellent mentor and partner, and I look forward to continue working with him," she says.

Norman Maiwashe, another ARC scientist who supervises Mapholi, is us-



MIKE MACNEIL (D2305-1)

Lehotlo Ephraim Matjuda, senior manager of Animal Breeding and Improvement for the Agricultural Research Council's Animal Improvement Institute, with cattle from his farm in Limpopo Province, South Africa. These cattle have body types and color patterns typical of the Nguni breed.

ing MacNeil's expertise to study cattle-breeding objectives for small farmers in remote African areas. His philosophy is best summarized in the adage that if you give a man a fish, it feeds him for a day, but if you teach him to fish, he can feed himself for life. "We're trying to build the sort of intellectual capacity for cattle breeding in South Africa that allows scientists to do research that carries the people far into the future," he says.

Maiwashe also credits MacNeil with making him a better teacher and scientist. "As a relatively young scientist, I think I learned a lot from him—subtle things that you might not learn in school. When you work with students, you have to be patient, and he taught me the importance of having patience," says Maiwashe, 37, who earned his doctorate at Colorado State University.

Genetic Diversity of Nguni

Este van Marle-Köster, a senior lecturer at the University of Pretoria, invited MacNeil to speak at a conference in South Africa 3 years ago and is now working with him on a study of the genetic architecture of Nguni. Across South Africa, there are at least five different "ecotypes" of Nguni cattle, found in different geographic regions. Each ecotype is easy to distinguish because of unique coloring patterns, body shapes, or other characteristics, according to Van Marle-Köster, who is leading the study. The rural areas are very village oriented, and each village has its own cattle population. One concern is that as Nguni are increasingly crossbred with European cattle, genetically unique lines of Nguni, with useful locally adapted genes and traits, could eventually be diluted and lost.

As part of their study, the researchers are collecting blood samples from about 600 Nguni cattle scattered throughout South Africa. They plan to study the DNA in each sample to develop a better understanding of the genetic makeup of the herds, track relationships within the population, and possibly identify the genetic basis for traits that make Nguni so adaptable. They are using MacNeil's database of microsatellite markers of the bovine genome as reference points. They could find that the entire population is one intermixed group or that there are distinct subpopulations worth preserving as sources of desirable traits.

"The main objective will be to evaluate the population from a genetic standpoint and provide guidance for management strategies as well as focus future conservation efforts," says Van Marle-Köster.

Dairy Ranching

In another study, MacNeil is helping Maiwashe and Scholtz determine breeding objectives for cattle in remote areas in South Africa that are used in dual-purpose dairy-ranching operations. By day, farmers allow calves and cows to graze together, but they separate the calves from their mothers at night so that the calves can't nurse. While the calves may get less total milk, they nurse enough during the day to grow and stay healthy. Such dairy-ranching operations are labor intensive, but they provide additional economic opportunity for the rancher through milk that can be sold daily.

The researchers are evaluating the costs and production levels associated with Nguni and three other breeds that are also used in dairy-ranching operations: Gir, Jersey, and Red Poll. The goal is to develop breeding objectives based on productivity, which includes milk and calf production, and costs to feed and maintain the cows.

"We want to get accurate baseline information. We're asking what kind of costs and production levels we'd see if we use these breeds in these environments and production systems," says Scholtz.

A central theme in all the work is that the ideas for projects originate with scientists in South Africa, MacNeil says. That approach ensures that African priorities are addressed and that the scientists "take ownership" of the research. Projects are designed with an awareness of the nation's cultural paradigms, such as the value placed on cattle as symbols of wealth in rural areas.

"You or I might say we should just find ways to help farmers produce cattle at low cost, sell them at the highest price, and put the money in the bank," MacNeil explains. "But in developing areas, people keep cattle as a representation of wealth and status. They view cattle as their bank, and if they sell their cattle, the source of their wealth is gone."—By **Dennis O'Brien,** ARS.

MIKE MACNEIL (D2304-1)

This Nguni bull has been evaluated with the Agricultural Research Council's Animal Improvement Institute performance testing scheme. His progeny contribute to the South African cattle evaluation system for genetic improvement of Nguni.

This research supports the USDA priority of promoting international food security and is part of Food Animal Production, an ARS national program (#101) described at www.nps.ars.usda.gov.

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