

GRADUATE AND POSTDOCTORAL STUDIES

MCGILL UNIVERSITY



FINAL ORAL EXAMINATION
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

OF

MEGAN DILBONE
DEPARTMENT OF PLANT SCIENCE
BUILDING SEED SUSTAINING HOUSEHOLDS: DEFINING SEED
SECURITY THROUGH INFORMAL SEED SYSTEMS AND
INTRASPECIFIC DIVERSITY ON SEMI-ARID, RESOURCE POOR FARMS
IN KENYA

Monday, March 30, 2015
2:15 pm

Macdonald Stewart Building, MS2-022
McGill University, Macdonald Campus

COMMITTEE:

Dr. N. Ross (Pro-Dean) (Geography Department)
Dr. M. Stromvik (Chair) (Department of Plant Science)
Dr. T. Johns (Supervisor) (School of Dietetics and Human Nutrition)
Dr. J. Singh (Internal Examiner) (Department of Plant Science)
Dr. A. Watson (Internal Member) (Department of Plant Science)
Dr. T. Meredith (External Member) (Geography Department)
Dr. Martin Kreiswirth, Dean of Graduate and Postdoctoral Studies
Members of the Faculty and Graduate Students are invited to attend

ABSTRACT

In resource poor farming systems, particularly those subject to environmental stress, agrobiodiversity is an important aspect of local livelihoods, food security, and seed security. Seed security refers to a farmer's ability to access and utilize available seed that is of good physiological quality and appropriate for local ecological and social contexts. The objectives of this thesis focus on understanding how access to different types of crops and varieties, through informal and formal seed systems, can contribute to reversing chronic household seed insecurity and support food production in semi-arid Kenya. In doing so, the research also aims to highlight local crops, varieties, knowledge, management strategies, and social organizations related to seed systems in Tharaka-Nithi County. A quantitative study used a household survey and the polytomous Rasch model to measure household chronic seed insecurity in three semi-arid counties in Kenya. Households were sorted into four categories ranging from seed secure to severely seed insecure. Variables of seed access, variety diversity, and household characters were compared among households in the four categories. There was no statistically significant difference between seed secure households and the other three categories of increasing seed insecurity for crop richness, variety richness, varieties per crop, and the Shannon-Wiener Index. Size of household, age of respondent, and years of farming experience were statistically significant. Severely seed insecure households averaged one more household member than seed secure households. A mixed methods study presents a detailed appraisal of local and regional seed exchange and seed saving that have contributed to seed security since time immemorial in Tharaka-Nithi County. Results from oral histories, semi-structured interviews, and a household survey suggest that introduced varieties of seed have actually added to variety diversity rather than degraded it through complete displacement of local indigenous varieties. Historical migrations to and from, and within, Tharaka have been key for introducing new seeds, establishing patterns of variety clustering, and mediating climatic stress. Over-time, local markets have replaced the need for long distance seed trade and are used by farmers to obtain lost or new varieties during times of acute stress, and are often relied on seasonally for legume seeds.

A qualitative study of pearl millet (*Pennisetum glaucum* (L.) R. Br.), an important traditional food preserved through the informal seed system in Tharaka, documented ten pearl millet varieties maintained by farmers and two extinct pearl millet varieties. Farmers in Tharaka manage risk of crop

failure and heterogeneous rainfall patterns by mixing early and late maturing varieties of pearl millet, a practice followed since time immemorial. However, over time introduced varieties that mature earlier and introduced varieties that provide more yields have replaced the old indigenous varieties. Seed selection practices focus on long panicles and big seed as well as rogueing out off-types called mathara.

A qualitative study identifies contemporary challenges of formal seed sector participation and access to seed of modern varieties in Tharaka. Results are discussed in relation to national seed policy, formal seed sector development, and seed system integration in Kenya. Thirty-nine percent of surveyed households reported that they had not grown seed of a modern variety originating from the formal seed sector in the last four seasons. The majority of modern varieties were accessed through reoccurring distribution of free seed, while maize seed was the only crop commonly accessed through agroshop purchase. Most farmers recycle seed that they receive from the formal seed sector.

This research presented a novel measurement of chronic seed insecurity and documents important social aspects of seed systems which contribute to the conservation of agrobiodiversity. The results will be useful to local and regional evaluations of seed security and national seed policies seeking to represent and integrate the challenges and realities of resource poor farmers. The results may also aid special efforts focused on in-situ conservation of the unique cultural and ecological diversity preserved by farmers in Tharaka.

CURRICULUM VITAE

UNIVERSITY EDUCATION

- 2011-2015 **PhD Candidate.** Plant Science.
McGill University. Montreal, Quebec.
- 2009-2011 **Master's of Science.** Environmental
Studies. University of Victoria. Victoria,
British Columbia
- 2005-2009 **Bachelor of Science.** Biology
Ohio Northern University. Ada, Ohio.

EMPLOYMENT

- April 2015 **Post-doctoral researcher**
University of California, Berkeley
- 2009-2011 **Ecological Processes, Lab Instructor**
School of Environmental Studies, University of Victoria.
- 2010 **Ethnoecology, Teaching Assistant**
School of Environmental Studies, University of Victoria.
- 2008-2009 **Plant Systematics, Teaching Assistant**
Biology Department. Ohio Northern University.

AWARDS

- 2011-2014 International Development Research Centre Canada
Fellowship.
- 2011-2013 Graduate Excellence Award. McGill University.
- 2009-2011 Pacific Century Award. University of Victoria.

PUBLICATIONS

- Mucioki, M., Mucioki, S.K., and Johns, T. (2014). Intraspecific diversity and seed management of pearl millet (*Pennisetum glaucum* (L.) R. Br) in Tharaka, Kenya: a persistent and valued traditional food crop. *Economic Botany*. 68(4), 397-409.
- Mucioki, M., Johns, T., and Mucioki, S. (accepted November 2014). Gendered food and seed producing traditions for pearl millet (*Pennisetum glaucum*) and sorghum (*Sorghum bicolor*) in Tharaka-Nithi County, Kenya. In Brownhill, L., Njuguna, E., Bothi, K.L., Muhammad, L., and Hickey, G.M. (Eds.) *Food Security, Gender and Resilience: Supporting Smallholder and Subsistence Farming Systems in Semi-Arid Kenya*. Earthscan: Oxford, United Kingdom.
- Dilbone, M. (2013). Pearl Millet Diversity in Tharaka-Nithi County, Kenya. *InRef News, KARI-McGill Innovations for Resilient Farm Systems*. Issue 3.
- Dilbone, M. (2013). Humble pine provides springtime treats. *Williams Lake Tribune, Casual Country Edition*. 93-95.
- Dilbone, M., Turner, N.J., and von Aderkas, P. (2013). Lodgepole Pine Cambium (*Pinus contorta* Dougl. Ex Loud var. *latifolia* Engelm. Ex S. Wats.): A Springtime First Peoples' Food in British Columbia. *Ecology of Food and Nutrition*. 52(2), 130-147.