TO: Alliance for African Partnerships
DATE: April 23, 2019
RE: AAP African Futures Program PROPOSAL

Background

Smallholder farmers play a key role in food security and agricultural development around the globe, yet yield gaps remain stubbornly high. Achievable crop yields are often three fold higher than attainable yields. It is urgent that this gap be narrowed – particularly in sub Saharan African rural communities. Agronomic research and extension may be missing the mark with recommendations that do not take into account local environments and farmer practices. Farmers of Central Malawi practice mixed maize rainfed farming systems that are broadly typical of smallholder farmers, thus we have established a study site with over 600 farmers and 1200 fields, where we are monitoring socio-economic, farm management, farmer preferences, soil properties and crop performance all to provide novel insights into how to support productivity gains in sub Saharan Africa. The agroecology research group I lead uses multidisciplinary research approaches, and collaborates with geographers, agricultural economists, statisticians, nutritionists, environmental and soil scientists to better understand Agri-Food systems, a key theme of the Alliance for African Partnerships. To learn more about my research group check out http://www.psm.msu.edu/people/sieglinde_snapp and the research learning lab website that describes our on-going research in Malawi and Tanzania: http://globalchangescience.org/eastafricanode

The African RISING team initiated in 2012 a learning lab with four research sites in Dedza and Ntcheu districts of central Malawi, and in 2016 expanded to include three additional research sites in Machinga district, Southern Malawi (see map on landing page of above website). This research involves over 1000 farmers and a dozen extension staff, working with our team of researchers from MSU, LUANAR (Bunda College Campus), ICRISAT, CIAT and IITA to support identification of integrated fertilizer recommendations and best bet options, including food legumes that have a leafy, vegetative growth habit that compliments maize production by providing a soil fertility bonus.

Farmer adaptation is a unique aspect of this participatory research, where we seek to improve knowledge of crop production and farmer practices that are feasible, match local resources, and are sustainable. We use the "Mother-Baby trial" approach (Snapp, 2002). Scientists, extension and farmers have over a number of years worked to together to test combinations of complementary legumes such as pigeonpea (slow growing semi-perennial) intercropped with an understory of soybean (fast growing annual). This is referred to as a "double-up legume rotation" (DLR), a technology recently released by the Malawi Government as a recommended practice for resource limited farmers and as a soil rehabilitation approach. The goal is to identify crop combinations that show promise in terms of ability to improve soil fertility in a marginal environment, yet at the same time fit farmer requirements, including labor availability and producing income opportunities and food that is nutritious and complimentary to the maize staple. At the center of our research approach is an iterative process, whereby researchers lead a partnership with farmers and extension staff, to initially identify potential 'best bet' options (Snapp, 2002).

Research opportunity

At our Malawi research sites we have established dozens of 'mother trials', where a full suite of SI technologies are tested in a long-term and replicated manner. Groups of fifty or more farmers are engaged at each mother trial site, and each farmer chooses which technologies to try out on his or her farm, as a 'baby trial' (Chikowo et al., 2019). The baby trials involve a simple comparison of two to six 'best bet' SI technologies with farmer's own practice. This has led to a success as a platform for co-learning regarding which technologies perform well, engaging over 1400 farmers. The research team works with Malawi extension to document farmers own ratings of technologies and adaptation to local conditions, leading to improvements such as plant spacing arrangements, combinations with fertilizer and local management practices (e.g., ratooning). Modeling and socio-economic surveys have been carried out in conjunction with the mother and baby trial design to expand the inference zone of research findings (Smith et al., 2016), for different climate and soil conditions. Farmer ratings of technologies and preferences as shown by local adaptations and uptake of varieties and management practices are monitored in a systematic manner. First, through short semi-quantitative surveys conducted at field days and other demonstration events (Snapp, 2002), and second, through a series of panel household surveys that monitor both participating, and non-participating, farmers.

As described in a recent manuscript (Snapp et al., in review): 'In addition to farmer participatory research, we have initiated in Malawi a household survey which is conducted as a panel, following methodologies developed by agricultural economists to assess rural household on a semi-regular basis. That is, the same farm households and associated plots are surveyed regularly, in our study once or twice a year since 2013, so as to build a data set on household characteristics, management practices and trajectories of field performance (Mungai et al., 2016). For the four learning community sites where we partner with extension and farmers we have visited a set of ~350 farmers on an annual basis (more frequently in some cases, to soil sample or assess weed management), monitoring maize yields through crop cuts taken in two fields per farm'.

Taken together, we have put together unique longitudinal and geo-referenced data sets that are available for considering research questions such as which practices and farmer types appear to be more resilient to extreme weather, which are achieving high productivity and improving soil fertility as well as other sustainable agri-food systems hypotheses. There have been some initial research studies conducted, that have highlighted gender (women's role in legume diversification), intercropping determinants, and the role of extension. Further, Bayesian and econometric regressions have been conducted with the first three years data which highlight weed issues that interact with soil fertility to influence maize yield response to fertilizer (Wang et al., ms. submitted and Kooper et al., ms submitted). However, the panel data sets now include 10 surveys, all interlinked, and a novel research opportunity is afforded here to 1) annotate the data sets and improve the meta-data, 2) conduct regression, path or spatial statistical analyses, 3) lead in research manuscript drafting and write up for publication key findings. My research group and collaborators, including a statistician and geographers, will provide full support for this important endeavor. We hold weekly research group meetings, write-ins, discuss responsible conduct for research and cutting edge research and extension approaches on a frequent basis.

Mentee opportunities

There would be three-fold opportunities as a mentee. **First,** importantly, you will be a full research scholar and member of my group, which includes leading scientific studies and analytical activities as described above, in close collaboration with my units, the Center for Global Change and Earth Observations, the Department of Plant, Soil and Microbial Sciences, and if you are interested, GenCen and African Studies at MSU. There will be numerous opportunities to present your research findings at local venues, and at least one international meeting. **Second,** you would be welcome to participate in teaching guest lectures, and to design an educational exercise as part of a course I have taught for a decade on 'International Agricultural Systems', a 3 credit course for seniors and graduate students. My textbook 'Agricultural Systems' edited with Barry Pound and now in a second edition, published by Academic Press, this is the basis for the course. The opportunities to participate with teaching would be very much based on your interests, and should you wish to expand your teaching portfolio you could explore new pedagogical approaches such as inquiry based learning. **Third,** my group is committed to developing new ways to reach farmers including innovative ICT and mobile app approaches to facilitate citizen science and locally relevant solutions that support farmer adaptation. It would be most welcome if you were to join our extension education efforts, to extend the research so as to reach more stakeholders.

As I have indicated in my application letter, I have had the opportunity to mentor students (24) and postdoctoral scholars (7) from many countries over my career. This has included five African women who received PhD degrees, and one postdoctoral scholar from southern Africa. For all of my students, trainees and postdoctoral advisees I have endeavored to provide a supportive environment that includes clear guidance on responsible conduct of research, on data management, on data analysis, publication guidelines and on interdisciplinary research that often includes novel farmer participatory action approaches. In addition, my research group members are afforded opportunities to reflect on career goals, on which tool sets they are most interested in obtaining (including soil analyses, statistical approaches and crop/soil simulation modeling), and guided to develop and test research hypotheses as a means to write effective grant proposals, and research papers. It is my sincere hope that a good fit will be found between my research group and an emerging African leader.

References

Chikowo, R., C. Gwenambira, V. Chimonyo and S. Snapp. 2019. Ecosystem services in doubled up legume systems. *In:* The role of ecosystem services in sustainable food systems. L. Rusinamhodzi (Ed). Elsevier

Kanyama-Phiri, G.Y., S.S. Snapp and S. Minae. 1998 Partnership with Malawian farmers to develop organic matter technologies. *Outlook on Agriculture* 27:167-175.

Mungai, L., et al. Smallholder farms and the potential for sustainable intensification. 2016. *Frontiers in Plant Science*. 7, 1720. DOI:10.3389/fpls.2016.01729

Smith, A., et al. 2016. Doubled-up legume rotations improve soil fertility and maintain productivity under variable conditions in maize-based cropping systems in Malawi *Agric. Systems*, 145:139–149.

Snapp, S.S. 2002. Quantifying farmer evaluation of technologies: The mother and baby trial design. pp.9-18. *In:* M.R. Bellon and J. Reeves (Eds.) "Quantitative Analysis of Data from Participatory Methods in Plant Breeding" CIMMYT, PRGA and IRRI, Mexico, DF. http://www.cimmyt.org/Research/Economics/map/research_tools /manual/Quantitative/quantifying_farmer.pdf

Snapp, S.S., J. DeDecker and A. Davis. Farmer participatory research on sustainable intensification: lessons from Michigan and Malawi. *Agronomy Journal*, ms in review

SIEGLINDE SNAPP
PROFESSOR OF SOILS & CROPPING SYSTEMS ECOLOGY

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Center for Global Change and Earth Observations tel: (1) 517-282-5644
East Lansing, MI 48895 USA http://www.psm.msu.edu/people/sieglinde_snapp

EDUCATION

Ph.D. 1992, Plant Physiology, University of California, Davis, CA
M.S. 1985, Crop Physiology, University of Minnesota, St. Paul, MN
B.S. 1983, Agronomy and Soil Science, Washington State University, WA

PROFESSIONAL EXPERIENCE

Associate Director, Center for Global Change and Earth Observations and
Professor of Soils and Cropping Systems Ecology, Department of Plant, Soil and Microbial Sciences, Michigan State University **2015-Current**
Interests: My research interests are in agricultural systems design and ecological-based management at multiple scales. My focus is on sustainable intensification of agriculture, including integrated nutrient management, perennial cover, and zonal tillage for enhanced production, soil health and ecosystem benefits. I lead multidisciplinary teams to scale sustainable agricultural practices, through participatory, action learning approaches in education and extension.
Professor, Soils and Cropping Systems Ecologist, Kellogg Biological Station and Department of Plant, Soil and Microbial Sciences, Michigan State University **2011-2014**
Associate Professor, Soils and Cropping Systems Ecologist **2006-2011**
Associate Professor, Integrated Vegetable Systems, Departments of Horticulture and Crop and Soil Science, Michigan State University **2004-2006**
Assistant Professor (1999-2004). Vegetable Integrated Crop Management, 50% Research/50% Extension. *Departments of Horticulture and Crop and Soil Sciences, Michigan State University, East Lansing, MI.*

International Crop and Soil Scientist (1996-1999). International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Lilongwe, Malawi.

Soil Scientist and Agronomist Fellow, **The Rockefeller Foundation** (1993 - 1996). Lilongwe, Malawi. Adjunct Assistant Professor, University of Malawi, Taught graduate courses in soil biology and fertility and cropping system ecology, co-supervised 3 graduate students. Visiting Research Fellow (7/94-9/94) International Center for Tropical Agriculture (CIAT) Cali, Columbia.
Post Doctoral Researcher (1992-1993). **The Pennsylvania State University**.
Research Assistant (1987-1991). **Univ. of California, Davis.**
NSF Fellow and **Research Assistant** (1983-1986). **Univ. of Minnesota.**

CURRENT RESEARCH

I lead a ten year **sustainable intensification of agriculture project in Malawi** with Dr. Chikowo, supported by USAID Feed the Future, and a four year SIIL funded project in Tanzania on '**Raising crop yields in corn and bean systems through bidirectional learning and SI'.** Our transdisciplinary learning lab involves collaboration with geographers, agricultural economists, agronomists, soil scientists, nutritionists, systems modelers and extension educators. We have engaged the interest of scholars and agricultural development actors from dozens of countries through our publications and our website http://globalchangescience.org/eastafricanode/. Our findings have informed agricultural policy in Malawi, and helped frame a new sustainable intensification indicators approach to assessing

performance and guiding technology choice. This sustainable intensification framework and manual was published by KSU SIIL and has been adopted by scientists in five countries and is widely recommended by USAID for agricultural development projects. http://www.k-state.edu/siil/resources/framework/index.html I co-developed and led a training for 30 scientists in Accar Ghana on implementation of the SI framework, and participated in an FAO Workshop on Agroecology assessment indicators.

Applied soil ecology and soil health research this year our project documented the role of aggregates in regulating soil carbon sequestration, nitrogen and phosphorus accrual in farming systems (articles in the SSSAJ and SBB). The limited ability of winter cereal cover crops to enhance soil C gain over eight years in a corn-corn-soybean rotation was a more sobering finding (*Soil Till. Res.*).

Citizen science and ICT outreach are key approaches to conducting research that is relevant and reaches millions of farmers in Africa. Through our learning lab in Malawi we have set up a unique test of the added value of precision targeting for mobile agricultural advice through farmer participation. Supported by the Big Data consortium of CIAT, we are comparing extension advice that is based on broad vs targeted messages. Over 10,000 farmers in Malawi and Zambia have been reached with our integrated nutrient management recommendations, and doubled up legumes, with promotion by Catholic Relief Services and extension.

CURRENT TEACHING

Co-developed MSU Graduate specialization in Ecological Food and Farming Systems (EFFS) and multidisciplinary, university-wide undergraduate minor in Sustainable Agriculture and Food Systems (SAFS). Teach Agricultural Systems CSS431 and International Agriculture Seminar CSS 294. Faculty advisor for minor in International Agriculture

ACADEMIC ADVISOR

International Agriculture Minor – Faculty advisor (20 undergraduate students)

Completed Degrees, Graduate committee member for 25 graduate students.

Major Advisor to 12 PhD and 12 MSc students who have completed degrees.

Currently: 5 PhD graduate students, 1 postdoctoral scholar and 1 technician.

DIVERSITY MENTORSHIP: ADVISOR TO 20 MINORITY STUDENTS, POSTDOCTORAL SCHOLARS AND VISITING SCIENTISTS

HONORS AND PROFESSIONAL ACCOMPLISHMENTS

Invited speaker at over 50 national and international meetings

2019 **Beal Outstanding Faculty Award, MSU**
2017-18 **Fulbright Fellowship**
2017- current **Associate Editor PLOS One**
2016 **Member of Editorial Board, Global Food Security**
2015 **International Service in Agronomy Award,** American Society of Agronomy
2010 Elected **Fellow of the American Society of Agronomy**
2009 **Fulbright Fellowship**
2008 **John K. Hudzik Emerging Leader in International Studies Award**, MSU
2006 - current **Associate Editor, Agronomy Journal**
1991 Outstanding PhD Graduate Student, Vegetable Crops Dept., UC Davis
1983 Outstanding Agronomy Senior, Washington State University

BOOKS

Snapp, S.S. and B. Pound (Eds.) 2017 (2008 First Edition). Agricultural Systems: Agroecology and Rural Innovation for Development. Second Edition. Academic Press. 440 pp.

Pound, B. S.S. **Snapp**, C. McDougal and A. Braun (Eds.) 2003. Uniting Science and Participation: Managing Natural Resources for Sustainable Livelihoods. Earthscan, U.K. and IRDC, Canada

Journal Publications (***133 TOTAL; 20 KEY ARTICLES BELOW)***

Snapp, S.S., C. Cox and B. Peter. 2019. Scaling multipurpose legume crops for smallholders in Africa *Global Food Security*, Ms. in press

Jongwoo, K., N.M. Mason and S.S. **Snapp**. 2019. Does sustainable intensification of maize production enhance child nutrition? Evidence from rural Tanzania. *Agricultural Economics, in press*.

Mpeketula, P. and S.S. **Snapp**. 2018. Structural Stability Conditions Soil Carbon Gains From Compost Management And Rotational Diversity, *Soil Sci. Soc. Am J.*, Ms in press.

Snapp, S., R. Bezner Kerr, V. Ota, D. Kane, L. Shumba and L. Dakishoni. 2019. Unpacking a crop diversity hotspot: Farmer practice and preferences in Northern Malawi. *Intl. J. Sust.Ag., in press.*

Jayne, T.S., S. **Snapp**, F. Place, and N. Sitko. 2019. Sustainable intensification in an era of rural transformation in Africa. *Global Food Security*, in press.

Bezner-Kerr, R. J. Kangmennaang, L. Dakishoni, H. Nyantakyi-Frimpong, E. Lupafya, L. Shumba, R. Msachi, G. Odei Boateng, S.S. **Snapp**, A. Chitaya, E. Maona, T. Gondwe, P. Nkhonjera and I. Luginaah et al. 2019. Participatory agroecological research on climate change adaptation improves smallholder farmer household food security and dietary diversity in Malawi. *Agriculture, Ecosystems and Environment, in press*.

Bezner Kerr, R. et al. and S.**Snapp**. 2019. Farming for change: developing a participatory curriculum on agroecology, nutrition, climate change and social equity. Agric. and Human Values, Ms in press.

Snapp, S.S., P. Grabowski, R. Chikowo, A. Smith, E. Anders, D. Sirrine, V. Chimonyo and M. Bekunda. 2018. Maize yield and profitability tradeoffs with social, human and environmental performance: Is sustainable intensification feasible? *Agricultural Systems* 162: 77-88.

Snapp, S.S., Rogé, Okori, P., Chikowo, R., Peter, B., and Messina, J.P. 2018. Perennial grains for Africa: Possibility or pipedream? *Experimental Agriculture 1-22*.

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Garland, G., K. Bünemann, A. Oberson, E. Frossard, S. **Snapp**, R. Chikowo, J. Six. 2018. Phosphorus cycling within soil aggregate fractions: A conceptual model. *Soil Biology and Biochem.* 116:91-98.

Peter, B., L. Mungai, J.P. Messina, and S.S. **Snapp**. 2017. Nature-based agricultural solutions: Scaling perennial grains across Africa. *Environmental Research*. 159:283-290

Kravchenko, A. S.S. **Snapp**, G.P. Robertson. 2017. Field-scale experiments reveal persistent yield gaps in low input and organic cropping systems. PNAS *doi:10.1073/pnas.1612311114*

Messina, J.P., Peter, B. and S.S. **Snapp.** 2017. Reconsideration of the Malawian Farm Input Subsidy Program. *Nature Plants* #NPLANTS-16051706B

Rogé, P., T. Diarisso, F. Diallo, Y. Boiré, D. Goïta, B. Peter, M. Macalou, E. Weltzien and S.S. **Snapp**. 2017. Perennial grain crops in the West Soudanian Savanna of Mali: Perspectives from agroecology and gendered spaces. *International Journal of Sustainable Agriculture*, 15:555-574.

Kane, D., P. Rogé, and S. **Snapp**. 2016. A systematic review of perennial staple crops literature using topic modeling and bibliometric analysis. PLoS One 11:e0155788

Isaacs, K., S.S. **Snapp**, et al. 2016. Assessing the value of diverse cropping systems under a new agricultural policy environment in Rwanda. *Food Security* 8: 491–506

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Petersen, B. and S.S. **Snapp**. 2015. What is sustainable intensification: Views from experts. *Land Use Policy* 46:1-10 doi:10.1016/j.landusepol.2015.02.002

Robertson, G.P., K. Gross, S. Hamilton, D. Landis, T. Schmidt, S. **Snapp** and S. Swinton. 2014. Farming for services: An ecological approach to production agriculture. *Bioscience*. 64:404-415.

Snapp, S.S., et al. and G.Y. Kanyama-Phiri. 2014. Modeling and participatory, farmer-led approaches to food security in a changing world: a case study from Malawi. *Scheresse* 24:350-358.

Culman, S., S.S. **Snapp**, et al. 2012. Permanganate oxidizable carbon reflects a processed soil fraction that is sensitive to management. *Soil Sci. Soc. Am J* 76: 494-504.

Snapp, S.S. M.J. Blackie, R.A. Gilbert, R. Bezner-Kerr, and G.Y. Kanyama-Phiri. 2010. Biodiversity can support a greener revolution in Africa. PNAS 107: 20840-20845.

Drinkwater, L.E. and S.S. **Snapp**. 2008. Nutrients in agroecosystems: Rethinking the management paradigm. *Advances in Agronomy*. 92: 163-186.

Snapp, S.S., S.M. Swinton, et al., 2005. Evaluating benefits and costs of cover crops for cropping system niches. *Agronomy Journal 97:322-332*

Snapp, S.S., M.J. Blackie, C. Donovan. 2003. Realigning research and extension services: experiences from southern Africa. *Food Policy 28:349-363*

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Snapp, S.S. W. Kirk, B. Roman and J.D. Kelly. 2003. Root traits play a role in integrated management of *Fusarium* root rot in snap beans. *HortScience* 38:187-191.

Snapp, S.S., G. Kanyama-Phiri, B. Kamanga, R. Gilbert and K. Wellard. 2002. Farmer and researcher partnerships in Malawi: developing soil fertility technologies for the near-term and far-term *Experimental Agriculture* 38:411-431.

Snapp, S.S., D.D. Rohrbach, F. Simtowe and H.A. Freeman. 2002. Sustainable soil management options for Malawi: can smallholder farmers grow more legumes? *Agriculture Ecosystems and Environment* 91:159-174.

Snapp, S.S. and S.N. Silim. 2002. Farmer preferences and legume intensification for low nutrient environments. *Plant and Soil*. 245:181-192.

Snapp, S.S., V.D. Aggarwal and R.M. Chirwa. 1998 Note on phosphorus and genotype enhancement of biological nitrogen fixation and productivity of maize/bean intercrops in Malawi. *Field Crops Research* 58:205-212.

Snapp, S.S., P.L. Mafongoya and S. Waddington. 1998 Organic matter technologies to improve nutrient cycling in smallholder cropping systems of Southern Africa. *Agriculture, Ecosystems and Environment* 71:187-202.

Phiri, R.H., S.S. **Snapp** and G.Y. Kanyama-Phiri. 1999 Soil nitrate dynamics in relation to nitrogen source and landscape position in Malawi. *Agroforestry Systems* 47:253-262.

Book Chapters ***(35 TOTAL – 5 KEY CHAPTERS BELOW)***

Grabowski, P., M. Musumba, C. Palm and S. **Snapp**. 2018. Sustainable agricultural intensification and measuring the immeasurable: Do we have a choice? *In:* S. Bell and S. Morse (Eds). Routledge Handbook of Sustainability Indicators and Indices, Taylor and Francis Press.

Chikowo, R., C. Gwenambira, V. Chimonyo and S. **Snapp**. 2019. Ecosystem services in doubled up legume systems. The role of ecosystem services in sustainable food systems. L. Rusinamhodzi (Ed). Elsevier

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Chikowo, R., S. Zingore, J. Nyamangara M. Bekunda, J. Messina and S. **Snapp**. 2014. Approaches to reinforce crop productivity under water- limited conditions in sub-humid environments in Africa. In: Sustainable Intensification to Advance Food Security and Enhance Climate Resilience in Africa (Lal R, Mwase D, Hansen F, Eds). Springer. 235-253pp.

Wellard, K. D. Kambewa, S.S. **Snapp**. 2011. Farmers on the frontline: Adaptation and change in Malawi. *In:* Climate Change and Indigenous Knowledge. D. Brokensha, P. Castro and D. Taylor (Eds.). Practical Action Publications, Rugby, UK.

EXTENSION LEADERSHIP AND PUBLICATIONS

Develop and extend novel participatory research and extension methods including on-farm research trial designs 'mother and baby' and 'mother and daughter' that have been adopted by scientists and extension educators in more than 30 countries in Africa, The Americas and Asia.

Establishment of a virtual, multidisciplinary place-based learning lab in Malawi: http://globalchangescience.org/eastafricanode/

Sustainable Intensification Indicators framework guide and manual: http://www.k-state.edu/siil/resources/framework/index.html

Participate in eXtension communities of practice for developing new crops, soil management and cover crops, and developed extension materials:
http://www.extension.org/pages/61075/managing-for-soil-organic-matter

Founding member, Perennial grain research and outreach community of the American Society of Agronomy
Perennial grain website http://pwheat.anr.msu.edu/
http://www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/fao-expert-workshop-on-perennial-crops-for-food-security/en/

Africa RISING sustainable intensification extension educational materials:
http://www.slideshare.net/africa-rising/esa-infographic2
http://www.slideshare.net/africa-rising/esa-infographic1
Odhong, J., Chikowo, R., Hoeschle-Zeledon, I. and **Snapp**, S. 2016. How does a farm family in Malawi produce more from their farm. Infographic. Ibadan, Nigeria: IITA.
Odhong, J., Chikowo, R., Hoeschle-Zeledon, I. and **Snapp**, S. 2016. Different strokes for different folks: 3-year doubled-up legume cropping cycles for contrasting farms in Malawi. Infographic. Ibadan, Nigeria: IITA.

'Resilient Legumes' FAO Year of the Pulse Webinar: http://fao.adobeconnect.com/p9bens9bbcu/

TECHNICAL AND POLICY DOCUMENTS (35 TOTAL; 5 KEY BELOW)

Snapp, S.S., Rahmanian, M., Batello, C. 2018. Pulse crops for sustainable farms in sub-Saharan Africa, Ed. T. Calles. Food and Agriculture Organization (FAO), Rome. 58 pp.

Msumba, M. Grabowski, P., Palm, C. and S.S. **Snapp**. 2017. Sustainable Intensification Assessment Methods Manual. Sustainable Intensification Innovation Lab, USAID Feed the Future. http://www.k-state.edu/siil/resources/framework/index.html

Jongwoo, K., N.M. Mason and S.S. **Snapp**. 2017. Does sustainable intensification of maize production enhance child nutrition? Evidence from rural Tanzania. Feed the Future Innovation Lab for Food Security Policy Research Brief 48. MSU

FAO, 2016. Agroecology profile 'Integrating diverse grain legume for increased land productivity on small farms in Malawi' http://www.fao.org/agroecology/knowledge/practices/en/

Chikowo, R., S.S. **Snapp** and I. Hoeschle-Zeledon. 2015 Doubled-up legume technology: Boosting land productivity by two grain legumes with different growth habits. Brief 11, Africa RISING, http://globalchangescience.org/eastafricanode/index.php/innovations/doubled-up-legumes/

Extension Bulletins ***(35 TOTAL; 5 KEY BELOW)***

Snapp, S.S., L. Tiemann, N. Rosenzweig, D. Brainard, and G. Bird. 2016. Soil health for root and tuber crops. Michigan State University Extension Bulletin. E3343.

Chikowo, R. and S. **Snapp**. 2016. Doubled-up legume technology: Boosting land productivity by intercropping two grain legumes with different growth habits. Africa RISING and Michigan State University. Africa-rising.net

Zystro, J., A. Shelton and S.S. **Snapp**. 2012. Participatory plant breeding tool kit, Organic Seed Alliance, Port Townsend, WA. http://www.seedalliance.org/Publications/#PPB

Snapp, S.S. and A.S. Grandy. 2011. Advanced soil organic matter management. Michigan State University Extension Bulletin. E3137.

Kanyama-Phiri, G.Y., **Snapp**, et al. 2000. Towards Integrated Soil Fertility Management in Malawi: Incorporating participatory approaches in agricultural research. Managing Africa's Soils No. 11. IIED, UK. www.iied.org/drylands

DATASETS

Malawi productivity of maize legume systems Dataverse doi:10.7910/DVN/R9Z3YA

SERVICE

Journal editor

Editorial Board: PLOS ONE and Global Food Security
Associate Editor: American Society of Agronomy
Review about 15 articles a year in addition.

USDA and NSF reviewer;

Professional memberships

Fellow of the American Society of Agronomy (ASA), elected 2010.
ASA Committees: Chair 2019 Sustainable Intensification Community;
ASA Board member, elected. Global Agronomy Representative, 2015-16 and 2017-2020; Fellows Committee, 2013 –2015; Rapid Response Team Member, 2012-2016.

MICHIGAN STATE UNIVERSITY SERVICE

Current:

Search Committee Member, African Studies Assistant Director
Mentor Committee Chair, Dr. Amos Ines, Assistant Professor, Agriculture Systems Modeler, Fixed Term Faculty, Plant, Soils and Microbial Sciences Dept. (2015- On going)
Mentor Committee, Dr. Regis Chikowo, Assistant Professor, Agriculture Systems Modeler, Fixed Term Faculty, Plant, Soils and Microbial Sciences Dept. (2013- On going)
Mentor Committee, Dr Karen Cichy, USDA and Adjunct Assistant Professor, Plant, Soils and Microbial Sciences Dept. (2013- On going)
Mentor Committee, Dr Lisa Tiemann, Assistant Professor, Plant, Soils and Microbial Sciences Dept. (2015-On going)
LTER Agronomy Committee, W.K. Kellogg Biological Station (2006-On going)

Talks ~ 3-10 per year to Michigan growers, crop advisors, industry representatives, Michigan Groundwater Stewardship Program, Michigan Extension, NRCS and other community groups

TECHNICAL ARTICLES FOR NEWSLETTERS, EXTENSION ALERTS– 61 TOTAL

INTERNATIONAL RESEARCH AND OUTREACH IMPACT

1.**Over 25 years experience in Africa**, including two times Fulbright sub-Saharan Africa Scholar, in 2010, based in Lilongwe Malawi with Univ. of Malawi, research on biodiversity in agricultural ecosystems. Second Fulbright in 2017 based in Arusha, Tanzania, research on citizen science and sustainable intensification in agriculture.

2. I currently lead a ten year **sustainable intensification of agriculture project in Malawi** through a contract with IITA on the 'Africa RISING' five country project funded by USAID and a four year SIIL funded project in Tanzania on '**Raising crop yields in corn and bean systems through bidirectional learning and SI'** http://globalchangescience.org/eastafricanode/

3. **As a Co-PI for 8 years on the 'Soils, Food and Healthy Communities' project in Malawi** we fostered adoption by over 10,000 farm families of multipurpose legumes, such as the pigeonpea-groundnut doubled up legume technology. Recent evidence from USAID study of widespread adoption of doubled up legumes into the neighboring country of Zambia and this technology is now **officially approved by the Malawi government, announced in Feb. 2016 by the Malawi Ministry of Agriculture,** Technology Release Committee: http://mwnation.com/double-up-legume-technology/

4. **As an international scientist for ICRISAT in the 1990s** I was based in Malawi and Zimbabwe, and led regional efforts to develop fertilizer recommendations and organic matter technologies for integrated nutrient management.

5. **Developed a trial design and extension approach ('mother and baby trial')** that has been adopted by scientists in over 30 countries. This quantitative method to systematically integrate farmer assessment and stakeholder input into research programs for more relevant and farmer-approved agronomic recommendations and adoption of improved maize, rice, wheat and legume genotypes in Asia, Africa and the Americas.

GRANT SUPPORT (16 MILLION TOTAL, GRANTS SINCE 2010 LISTED)

2012-2021	USAID (subcontract with IITA) 'Sustainable intensification of maize based systems in SE Africa' $7,800,000 PI **S. Snapp** (Co-PI Regis Chikowo)
2015- 2019	USAID Sustainable Intensification Innovation Lab, Kansas State University 'Raising crop response: bidirectional learning to catalyze sustainable intensification at multiple scales' $996,764 (**S. Snapp** PI, T. Jayne and N. Mason MSU co-PIs, K. Giller Wageningen University, Jean-Claude Rubyogo CIAT, N. Kassim, NMAIST, and H. Tindwa, Sokoine University of Agriculture, Tanzania)
2018-2019	'Jumpstarting soybean extension through decision support' S. Snapp and J. Dedecker, GREEEN $58,000 (including MSUE and Soybean Board match)
2017	Fulbright Fellowship: 'Citizen science with East African farmers'
2017-2018	USAID Sustainable Intensification Innovation Lab, Kansas State University 'Precision Agriculture in Malawi' PI J. Messina, Co-PIs S. Snapp and T. Jayne. 110,000 (Snapp)
2016-2018	Jumpstarting soybean production: on-farm epidemiology of tillage, soil properties, plant stand and yield' J. DeDecker and S. Snapp, GREEEN $105,000 (including MSUE match)
2016-2018	CERES Trust 'Grain and forage from intermediate wheatgrass' S. Snapp, K. Cassida and University of Minnesota C. Sheaffer, $39,900 (MSU)
2015-2016	Strengthening Agricultural and Nutrition Extension Systems in Malawi (SANESA), USAID funded, Univ. Illinois lead, MSU subcontract (S.Snapp PI, T. Jayne Co-PI, $200,500)
2015-2017	USAID Sustainable Intensification Innovation Lab, Kansas State University 'Sustainable Intensification Indicators: Are we there yet?' (S. **Snapp** PI MSU, C. Palm PI Columbia University, $290,000 MSU)
2012-2017	Global Center for Food Security and Innovation (E Crawford PI, 8 co-PIs including S. Snapp) USAID $24,919,790
2013-2015	Bill and Melinda Gates Foundation 'Systems analysis of perennial grain crops for African smallholder farming systems' $1,498,000 PI **S. Snapp**
2011-2014	CERES Trust 'Mycorrhizal role in organic row crop production long-term experimentation' $100,000 PI S. **Snapp**

2011-2015	USDA-AFRI 'Precision zonal management systems for resilient cereal yields and ecosystem services under variable climates' PI N. Jordan $4,500,000 Univ Minn. ($670,000 co-PI S. **Snapp**)
2010-2014	McKnight Foundation $430,000 'Legume Best Bets Two: For a Changing World' PI G. Kanyama-Phiri ($140,000 Co-PI S. **Snapp**).
2010-2016	CERES Trust 'Fostering complex soil food webs and building soil fertility with organic production: the potential of perennial wheat' $335,000 PI S. **Snapp**
2009-2010	Fulbright Fellowship: Diversity Dimensions of Healthy Agroecosystems in Malawi

Academic Advising **Student from underrepresented ethnic group*

Applied Development in International Agriculture and Natural Resources Minor – Faculty advisor

Undergraduate Student Research Interns and Honors Research Projects:
*Chiwimbo Gwenambira, *Iman Sylvain (ESA – SEEDS fellow), Richard Price, *Briana Shuford, Bryan Wallace, Rebecca Titus, Andrea Posigian, Jennifer Jenkins, Anne Scott

Current, Graduate Committee Member:
Eric Owusudanquah (PhD, CSS), Jong-Woo Kim (PhD, Agricultural Economics), Brad Peter (PhD, Geography), Alexia Witcombe (*PhD, CSS*), **Leah Mungai (PhD, Geography), Holly Hooper (MS, Entomology), Han Wang, (PhD, Statistics), D. Hoffman (PhD, CSS).*

Completed Degrees, Graduate Committee Member:
*Mary Parr (PhD.), Maksym Ivanyna (PhD.), *Ninh Hoan (M.S.), Megan Sheahan (M.S.), Ben Henshaw (M.S.), *Shahwar Salam* (M.S.), **Paligwende Nikiema* (*Ph.D.*), *Devan Berry (M.S.), Terry Loecke (Ph.D.), *Marcia St. Babtiste (Ph.D.), Jim Heilig (M.S.) *Keston Njira (M.S., Univ. Malawi), *Belinda Roman (Ph.D.), Katherine O'Neil (Ph.D.)***, ***Juan-David Robayo (Ph.D.) Michelle Hockett (M.S.), Erin Haramoto (Ph.D.), Shahlo Safarzoda (M.S.), Rich Price (M.S.), Sabra Gerdes (MS, CSS), Watson, Jacob Paul (MS, Comm. Sust.), Nzube Egboluche* (MS, CSS), **Gana Adebiyij (PhD, Comm Sust.).*

Completed Degrees and Current Degrees, Major Advisor (Advised 12 PhD and 12 MSc students):

DEGREE GRANTED	NAME	CURRENT POSITION
UNIVERSITY OF MALAWI – CO-ADVISOR		
1998, M.S.	*Rebbie Phiri (now Harawa)	Senior soil scientist at Alliance for a Green Revolution in Africa, Kenya
1998, M.S.	*Dickens Phiri	Conservation N.G.O., Mozambique
1999, M.S.	*Bernard Kamanga	Livinstonia University, Malawi
MICHIGAN STATE UNIVERSITY – MAJOR ADVISOR		
2002, M.S.	Heather Borden	Consultant
2003, M.S.	*Judith Nyiraneza	Scientist, Agriculture and Agri-Food Canada
2002-2005, Post doctoral scholar	Dr. Jinsheng Huang	Research Scientist, Univ. of Florida
2004, M.S.	*Kanchan Date	Raising family

2005, M.S.	Courtney Gallaher	Assistant Professor, Univ. N. Illinois
2006-2008, Post doctoral scholar	Dr. Claire McSwiney	Lecturer, Kalamazoo College, Michigan
2008, Ph.D.	Edgar Po	Scientist, Xavier University
2008, Visiting Scientist	Dr. Ålena Pivovaro	Professor, Altai State Agrarian University, Russian Federation
2008, Ph.D.	Karen Cichy	Plant Geneticist & Assoc. Adjunct Professor, USDA, East Lansing, Michigan
2009, Ph.D.	Tracy Beedy	Asst. Professor, Dept Plant and Soil Sciences, Oklahoma State Univ.
2008 and 2009, Visiting Scientist	*Bessie Green	University of Maryland, Eastern Shore
2009, Ph.D.	*Marthe Diallo	Senior Science Advisor, Christian Aid Foundation, Bamako, Mali
2009-2012, Postdoc.	Dr. Steve Culman	Assistant Professor, The Ohio State University
2010, Ph.D.	Brook Wilke	Farm Manager, MSU Kellogg Biological Station
2010, Ph.D.	*Wezi Mhango	Assistant Professor, Univ. of Malawi
2012, Postdoc.	Dr. Ariene Peralta	Post doctoral scholar, Purdue
2012, M.S.	Mary Ollenburger	Ph.D. Studies, Wageningen Univ., The Netherlands
2013, Ph.D.	Nikhil Jaikumar	Post doctoral scholar, Univ. Illinois
2014, Ph.D.	Krista Isaacs	Assistant Professor, Dept. Plant, Soil and Microbial Sci., MSU
2014, M.S.	*Sowmya Surapur	Private Industry
2012, M.S.	Sienna Tinsley	Extension educator, Vermont
2016, Ph.D.	*Placid Mpeketula	Assistant Professor, Univ. of Malawi
2013, M.S.	Dan Kane	PhD student, Yale University
2014, M.S.	Alex Smith	Farmer
2012-15 Postdoc.	*Dr. Regis Chikowo	Assistant Professor, Plant, Soil and Microbial Sciences, MSU and UZ
2018, Ph.D.	*Princess Adjei-Frimpong	Crop and Soil Sciences
2015, M.S.	*Chiwimbo Gwenambira	Crop and Soil Sciences
Current, Ph.D.	*Chiwimbo Gwenambira	Crop and Soil Sciences
2015-16, Postdoc.	Dr. Paul Roge	MESA, and Univ Calf. Berkeley
2015-17, Postdoc.	Dr. Phil Grabwoski	Assistant Professor, Taylor University, Indiana
Current, Ph.D.	Alison Nord	Crop and Soil Sciences
2016-18, Postdoc.	*Dr. Vimbayi Chimonyo	Crop and Soil Sciences
Current, Ph.D.	Xinyi Tu	Crop and Soil Sciences

TEACHING ACTIVITIES

Co-developed and Founding Member of Steering Committee for Sustainable Agriculture and Food Systems (undergraduate minor) and Ecology of Food and Farming Systems (graduate specialization)
Faculty Advisor for multidisciplinary undergraduate minor, Applied Development in International Agriculture and Natural Resources

Courses - Current
Agricultural Systems, CSS 431, 3 credits, Spring
International Agriculture Topics Seminar, CSS 294, 1 credit, Spring

Contribute lectures in HRT 893 Agricultural Ethics and CSS 442 Agroecology
Organized Seminar on Crop Ecology, Functional Traits

Courses – Past
Co-taught short course on Agroecology with Dr. Wezi Mhango and Dr. Anna Hull, University of Malawi, August, 2012 and January, 2014
Co-taught Ecological Food and Farming Systems Seminar CSS/ACR 892B, 1 credit, Fall
'Eating Green in Michigan' UGS 101 Freshman Seminar, Fall 2008
Co-designed and co-taught in 2006 and 2007 a new course - Soil Biology 360 (3 credits)
Organized Seminar on Soil Organic Matter (2004)
Taught CSS 893 Biogeochemistry of Sustainable Agriculture (2004)
Horticulture Graduate Seminar HRT 893 Sustainable Agriculture (2003)
Taught 4 to 6 lectures HRT 853 Plant Mineral Nutrition in 2001, 2002 and 2003

INVITED TALKS – SELECTED EXAMPLES LAST FIVE YEARS

Snapp, S. 2018. 'Perennial wheat for a sustainable future?' Plenary Speaker, The Future of Wheat, The Lake District, United Kingdom
'Sustainable Intensification: Lessons from Africa for the Corn Belt' Symposium, ASA, Nov 2016.
Symposium on Transforming Smallholder Agronomy in Africa: 'Extension stepping up the plate' Lightening talk, ASA November 9 2016
'Are We There Yet? Sustainable Intensification Indicators Role in Feeding the Future' ASA November 7, 2016
'Agroecology in the real world: Legumes making a difference in Africa' Seminar, FAO 'Year of the Pulse' November 2, 2016
'Development of a sustainable intensification indicators framework: reports from the frontline in Malawi' Tropentag, Vienna, Austria
'Perennial grains: Transformative option or pipe dream?' Plenary talk, Contested Agronomy Meeting, Institute for Development Studies 23-25 February, 2016, Brighton, UK.
Co-chair and Speaker 'Designing sustainable agricultural systems with legumes' Fifth International Farming System Design Course, Talk title: 'Greener food production in Africa: intensification through multipurpose legumes', August, 2015, Montpellier France
'Sustainable intensification in a world of change' Invited talk, Symposium on 'Perspectives on sustainably supporting the human populace in the future' American Society of Agronomy, Soil Science Society of America Annual Meeting, November 18, 2015, Minneapolis, MN.
'Perennials and cover crops for future cropping systems' Plenary talk, Penn. State University, Sustainable Agriculture 6th Annual Meeting, State College, PA, March, 2015.
'Advance soil organic matter management for sustainable production' Michigan Soil and Water Conservation Annual Meeting, March, 2014
'Back to the future in Rwanda: Is agricultural intensification being pursued at the expense of food security' with K. Isaacs, 2013. First International Conference on Global Food Security, Noordwijkerhout, The Netherlands, 29 Sept- 2 Oct., 2013