



Sustainable Agriculture and Natural Resource Management Collaborative Research Support Program

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Trip Report: Lesotho & South Africa Jan. 31, 2011 – Feb. 22, 2011

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Purpose of Trip: To facilitate, assist, and train individuals in baseline soils data collection in Roma and Matphutseng, Lesotho;
To attend the first Regional Conservation Agriculture Symposium in Johannesburg, South Africa.

Sites visited: Matphutseng, Lesotho;
Roma, Lesotho

Executive Summary:

Experimental plots were laid out, and bulk density and GPS data were collected at two sites in Lesotho: Matphutseng and Roma. Composite soil samples were obtained for some of the plots at Matphutseng at 0-5 and 5-10 cm depths. Additionally, the Regional Conservation Agriculture Symposium was attended in Johannesburg, South Africa, where the current state of conservation agriculture in southern Africa was discussed.

Description of activities:

In Matphutseng, Lesotho, we stayed with the Director of Growing Nations, August Basson, and his family. This is a faith-based organization who is promoting conservation agriculture (CA) in the area, and August serves as an extension agent for the region. We began work on Feb. 3, 2011 with a tour of his fields. The fields were mostly in maize, although there were some bean fields as well. There are fields under production, but also many fields that are currently under screening trials, i.e., non-replicated field plots to determine the feasibility of certain systems. Those that are most promising will likely be included in replicated studies for scientific testing. One promising screening trial involved the use of grazing vetch as a cover crop, which reportedly suppressed 95% of weeds, and visibly enhanced maize production compared to the non-cover crop adjacent to the plot, particularly because these plots received no fertilizer. In my

estimation, the amount of nitrogen (N) supplied by the grazing vetch cover crop was likely on the order of about 80 lbs/ac.

The site also contains a Bowen Ratio unit, which is an energy flux apparatus that measures small differences in energy above and below the canopy. The device is solar-powered and measures temperature, relative humidity, CO₂, solar radiation, soil moisture, soil temperature, wind speed, and total energy received at the soil level (what is not intercepted by the canopy).

While at Matphutseng, Wendy Bruns (MS student under Dr. Neal Eash) and I laid out field plots for time 0 sampling. Local students at Growing Nations were trained in composite soil sampling techniques, and used their training to assist in data collection. The soils at this site are 2:1 clays, with significant shrink-swell potential and high compressibility, making soil sampling difficult. Bulk density data is likely to be overestimated due to the compressibility of these soils, but every reasonable effort was made to limit this potential error.

The corners of each block were located by averaging waypoints until 100% sample confidence was obtained. Maps showing the layout are presented in Figures 1-3. Exact locations and elevation data are shown in Tables 1-3. Bulk density and field slope data are not shown, since they are not of general interest, but the exact locations of the sites may be of use to future collaborators working with this project.

Waypoints were determined on a Garmin GPSmap 62st by averaging waypoints until 100% confidence was obtained on Feb. 3, 2011 for the SP blocks, Feb. 13, 2011 for the SNT blocks, and Feb. 14, 2011 for the northern plots (NNT and NP). Post-processing was conducted using Garmin BaseCamp software, Version 3.1.3 on March 9, 2011. Imagery was obtained using Garmin BirdsEye imagery on March 9, 2011. Field slope was determined using a Brunton Clino Master handheld clinometer on Feb. 13-14, 2011.

Bulk density samples were obtained by using a 4.75 cm inner diameter cylinder with a length of 4.95 cm (for the 0-5 and 5-10 cm depths). Cores were taken on Feb. 4, 2011 on the SP blocks (at least 2 cores per block). Composite cores consisting of at least 25 one-inch cores were divided into 0-5 and 5-10 cm depths on Feb. 4, 2011. Bulk density cores were taken from the SNT bean-maize blocks on Feb. 13, 2011. Bulk density cores were taken from the northern plots (NNT and NP) on Feb. 14, 2011. Please see the Excel sheet entitled "Matphutseng – Soils data" (on sheet "Bulk Density") for bulk density and slope data.

On February 8-10, 2011, I attended the Regional Conservation Agriculture Symposium in Johannesburg, South Africa. The main thrust of the conference was to determine the state of CA in southern Africa and identify and remove constraints to CA in the region. The conference was supported by the FAO, and focused on the state of science on CA in southern Africa. Specific issues addressed included policy issues, climate change, technology performance, rural livelihoods, labor requirements, scale-up, training, institutional arrangements, and market innovations. A full list of the presentations as well as the presentations themselves can be found [here](#). Personally, I found the review of the state of the science in CA in southern Africa useful, particularly in terms of the technologies used, equipment development, and weed management.

Suggestions, Recommendations, and/or Follow-up Items:

While at Matphutseng, potential future collaborations were discussed, and included the possibility of conducting litterbag studies to quantify the amount of N contributed to a subsequent crop from various cover crops, particularly grazing vetch. Soil and/or residue incubation studies were also discussed, although the absence of constant temperature incubators (as well as a constant power supply) at the site could be problematic.

Follow up activities include post-processing the GIS data obtained at both sites and providing that information and resulting maps to the partners. Bulk density data will be calculated from the Roma site as soon as Dr. Marake's (Department Head, Soils Department, National University of Lesotho) lab technician (Mofile) dries the soil cores.

Training Activities Conducted:

Program type (workshop, seminar, field day, short course, etc.)	Date	Audience	Number of Participants		Training Provider (US university, host country institution, etc.)	Training Objective
			Men	Women		
Field training	Feb. 3, 2011	Student		1	Soils CCRA, VT	Selecting and squaring research plots
Field training	Feb. 4, 2011	Students	1	2	Soils CCRA, VT	How to obtain composite and intact soil cores and use a clinometer
Field training	Feb. 14, 2011	Students	2		Soils CCRA, VT	How to obtain composite and intact soil cores; Clinometer use

List of Contacts Made (Lesotho):

Name	Title/Organization	Contact Info (address, phone, email)
Wendy Bruns	UTK MS Student, Matphutseng site	wjones12@utk.edu
August Basson	Director, Growing Nations	sonnetjies.basson@gmail.com
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List of Contacts Made (Johannesburg Conference):

Name	Title/Organization	Contact Info (address, phone, email)
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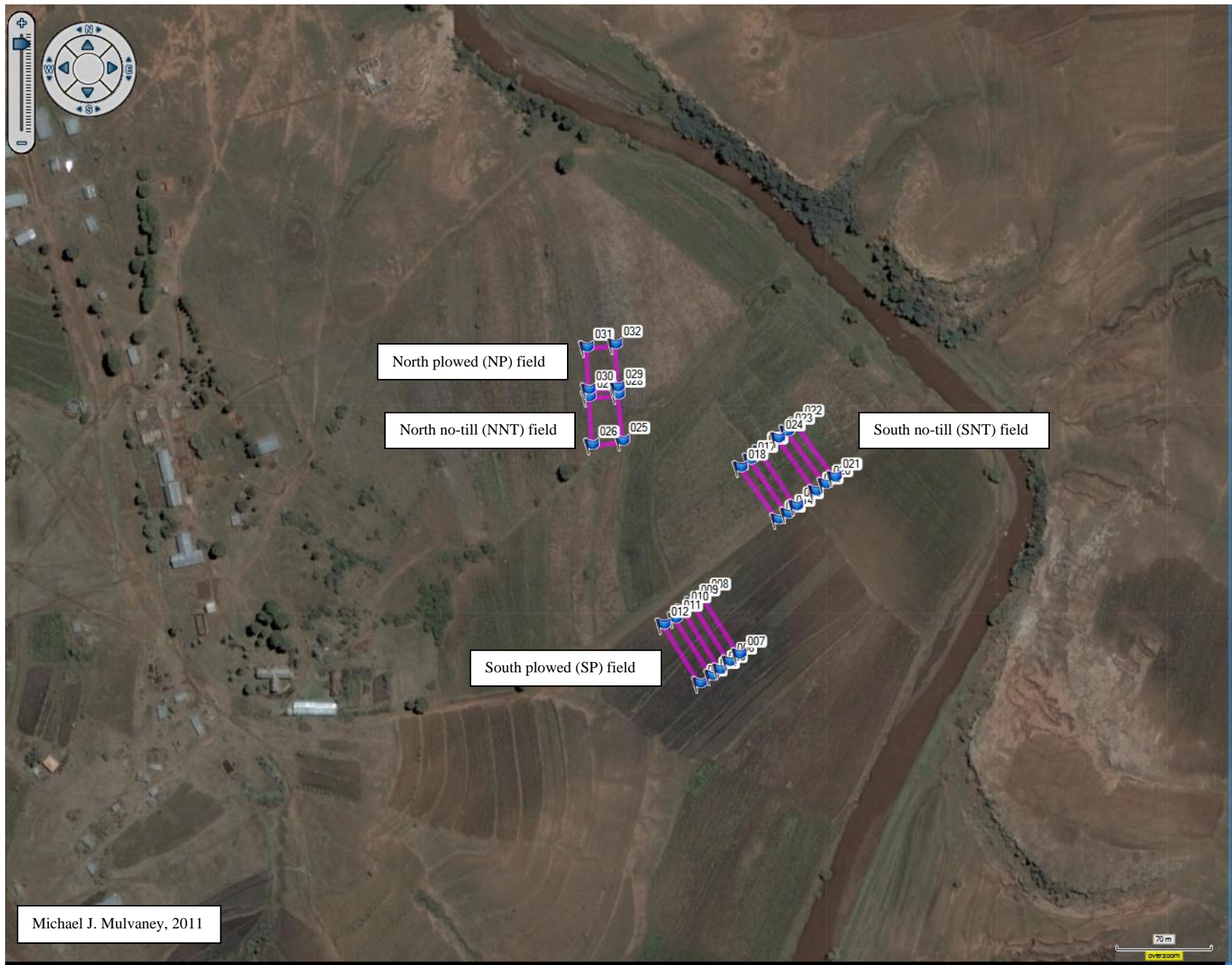


Figure 1. Overall view of research plots in Matphutseng, Lesotho. Please note that the image overlay is shifted approximately 10 m to the NW.



Figure 2. Overall view of blocked research plots in Matphutseng, Lesotho. Note that the image overlay is shifted approximately 10 m to the NW. The south plowed (SP) field was in maize at the time of measurement (Feb. 3, 2011). Reps 1-2 of the south no-till (SNT) field were in maize while reps 3-4 were in beans at the time of measurement (Feb.13, 2011). Each block (or rep) measures 9x50 m. Blocks (reps) are numbered from SW to NE.

Table 1. GPS data for the south plowed (SP) blocks, planted in conventional tilled maize during 2010/11. This field is located southeast of the road. These plots will be turned into no-till to monitor the improvement of a poor soil.

Block	Northern waypoint	Eastern waypoint	Southern waypoint	Western waypoint
1	Waypoint 11 S30°12'49.8" E027°29'41.3" 1455 m elev.	Waypoint 4 S30°12'51.1" E027°29'42.4" 1453 m elev.	Waypoint 3 S30°12'51.3" E027°29'42.0" 1454 m elev.	Waypoint 12 S30°12'49.9" E027°29'41.0" 1452 m elev.
2	Waypoint 10 S30°12'49.6" E027°29'41.6" 1450 m elev.	Waypoint 5 S30°12'51.0" E027°29'42.6" 1454 m elev.	Waypoint 4 S30°12'51.1" E027°29'42.4" 1453 m elev.	Waypoint 11 S30°12'49.8" E027°29'41.3" 1455 m elev.
3	Waypoint 9 S30°12'49.4" E027°29'41.8" 1449 m elev.	Waypoint 6 S30°12'50.8" E027°29'42.9" 1455 m elev.	Waypoint 5 S30°12'51.0" E027°29'42.6" 1454 m elev.	Waypoint 10 S30°12'49.6" E027°29'41.6" 1450 m elev.
4	Waypoint 8 S30°12'49.2" E027°29'42.1" 1455 m elev.	Waypoint 7 S30°12'50.6" E027°29'43.2" 1454 m elev.	Waypoint 6 S30°12'50.8" E027°29'42.9" 1455 m elev.	Waypoint 9 S30°12'49.4" E027°29'41.8" 1449 m elev.

Table 2. GPS data for the south no-till (SNT) blocks, planted in no-till maize and bean rotation during 2010/11. This field is located northwest of the road. The gap between reps 1-2 and 3-4 is due to a dead zone in between the blocks.

Block	Northern waypoint	Eastern waypoint	Southern waypoint	Western waypoint
1 Maize No-till	Waypoint 17 S30°12'46.0" E027°29'43.5" 1456 m	Waypoint 14 S30°12'47.3" E027°29'44.6" 1456 m	Waypoint 13 S30°12'47.4" E027°29'44.3" 1458 m	Waypoint 18 S30°12'46.2" E027°29'43.2" 1457 m
2 Maize No-till	Waypoint 16 S30°12'45.8" E027°29'43.8" 1455 m	Waypoint 15 S30°12'47.1" E027°29'44.8" 1457 m	Waypoint 14 S30°12'47.3" E027°29'44.6" 1456 m	Waypoint 17 S30°12'46.0" E027°29'43.5" 1456 m
3 Beans No-till	Waypoint 23 S30°12'45.3" E027°29'44.6" 1456 m	Waypoint 20 S30°12'46.6" E027°29'45.7" 1457 m	Waypoint 19 S30°12'46.7" E027°29'45.4" 1457 m	Waypoint 24 S30°12'45.5" E027°29'44.3" 1455 m
4 Beans No-till	Waypoint 22 S30°12'45.1" E027°29'44.8" 1456 m	Waypoint 21 S30°12'46.4" E027°29'46.0" 1457 m	Waypoint 20 S30°12'46.6" E027°29'45.7" 1457 m	Waypoint 23 S30°12'45.3" E027°29'44.6" 1456 m



Figure 3. View of northern unblocked plots in Matphutseng, Lesotho. Please note that the image overlay is shifted approximately 10 m to the NW.

Table 3. GPS data for the north fields, fallow during 2010/11. These plots measure 24 x 33.2 m and were not blocked, with a 5 m alley in between the fields. The north plot is currently under tillage (NP), while the south plot is currently under no-till (NNT). Note that elevation data are approximately 4 feet off the ground, at chest height.

Plot	Northern waypoint	Eastern waypoint	Southern waypoint	Western waypoint
No-till fallow (North no-till, NNT)	Waypoint 28 S30°12'44.4" E027°29'39.7" 1460 m	Waypoint 25 S30°12'45.5" E027°29'39.8" 1460 m	Waypoint 26 S30°12'45.6" E027°29'38.9" 1462 m	Waypoint 27 S30°12'44.5" E027°29'38.8" 1463 m
Plowed fallow (North plowed, NP)	Waypoint 32 S30°12'43.2" E027°29'39.6" 1465 m	Waypoint 29 S30°12'44.3" E027°29'39.7" 1463 m	Waypoint 30 S30°12'44.4" E027°29'38.8" 1465 m	Waypoint 31 S30°12'43.3" E027°29'38.8" 1465 m

It is intended that the blocks within the SNT and SP fields will be divided into 20 experimental units (or plots), each measuring 4.5 x 10 m.