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BACKGROUND

Declining rainfall, high spatio-temporal rainfall variability, continuous farming without replenishing soil nutrients coupled with high cost of fertilizers discourage most of small-scale poor farmers in semi-arid Sub-Saharan Africa (SSA) from using recommended amounts of fertilizers to improve soil fertility and sustain crop production. Crop upgrading strategies (UPS) that are relatively inexpensive and effective are necessary for overcoming these challenges. A promising UPS is infield rainwater harvesting (RWH) (Fig. 1) and microdose fertilization.



Figure 1a: Infield RWH (tied ridges)



Figure 1b: Manual rain gauge in pearl millet plot in Idifu

OBJECTIVES

- (i) To analyse the extent of rainfall variability within a small agricultural watershed in this area.
- (ii) To evaluate the significance of the rainfall variability on pearl millet yield and;
- (iii) To evaluate the effectiveness of the UPS that reduce the effects of rainfall variability and poor soil fertility on pearl millet yield within a small agricultural watershed.

METHODS

- We used K-Means Algorithm to locate centroid of rain gauges positions that inscribe polygons of approximate area of 0.25 km² over an area 12.5 km² of an agricultural watershed (Fig. 3)
- The season for data collection were 2015/2016 and 2016/2017.
- FAO CROPWAT model was used to calculate the daily, decade (10 days), monthly and seasonal crop evapotranspiration (ETc) of pearl millet in the study area
- We recorded pearl millet yields under flat cultivation, in-situ rainwater harvesting (tied ridges) and fertiliser micro-dosing for each rain gauge position.
- Microdose was 7.5 KgP/ha of Triple Super Phosphate fertilizer

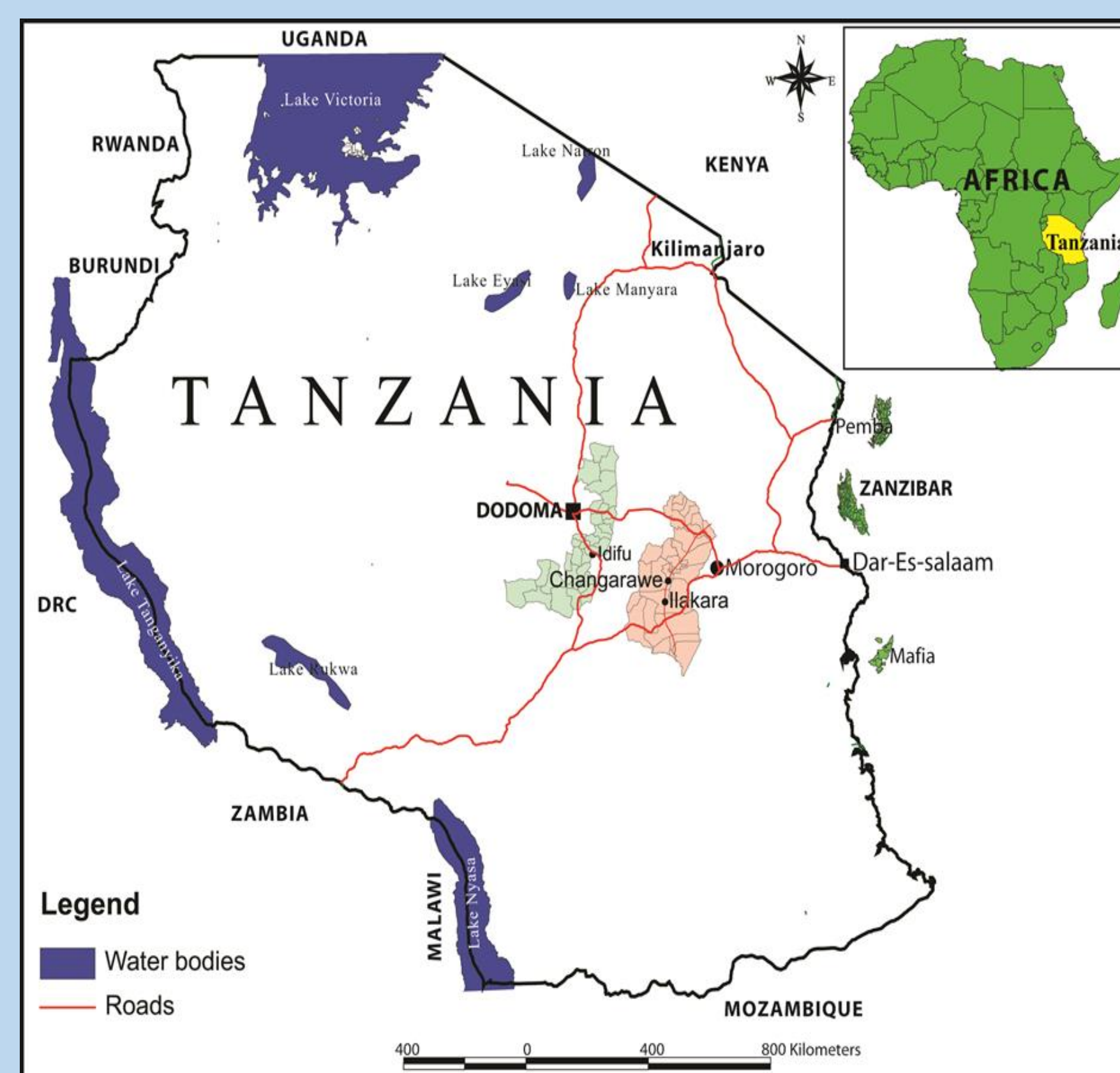


Figure 2: A map for study site location in Idifu, Dodoma Tanzania

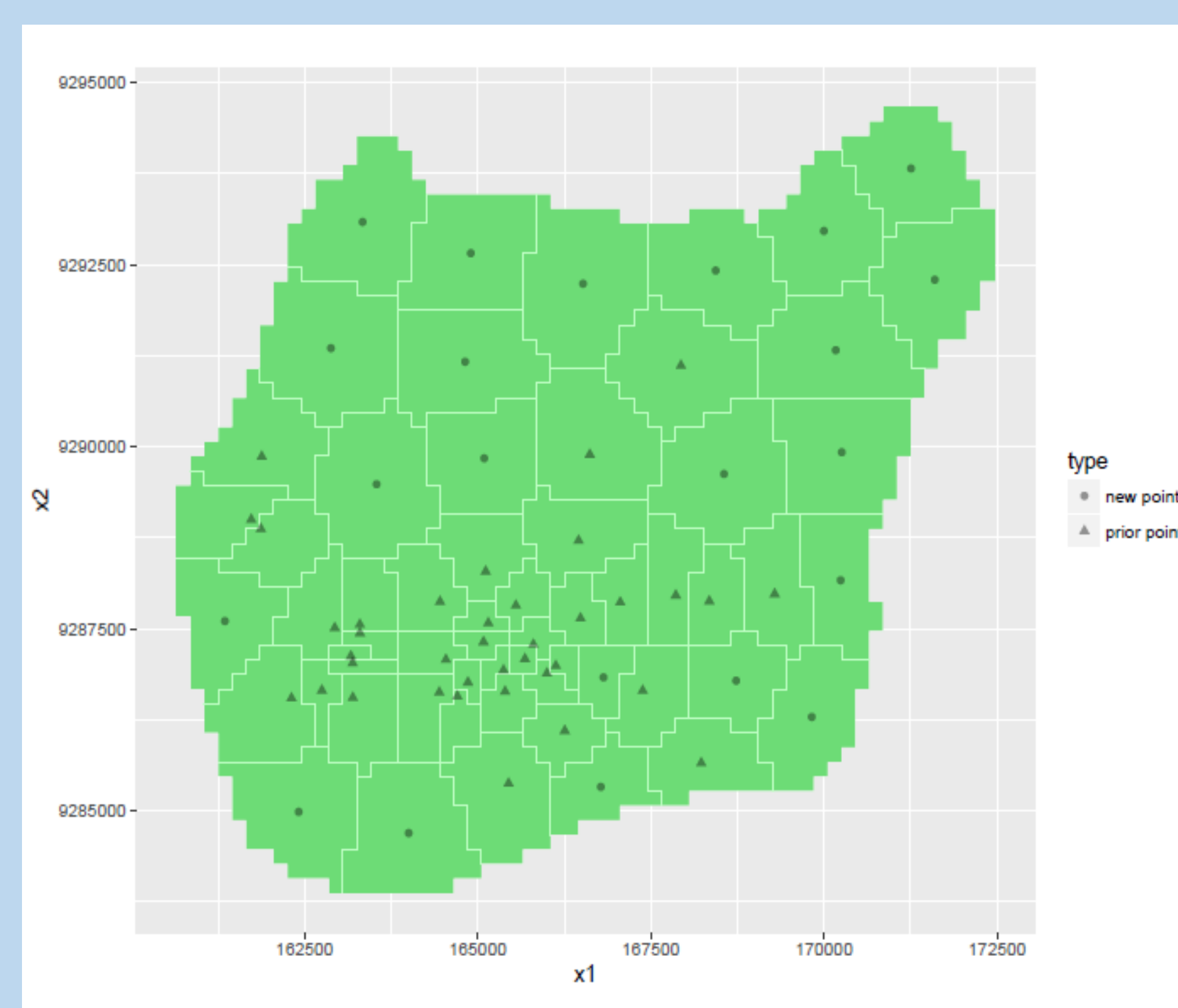


Figure 3: Rain gauges set up at Idifu village

RESULTS AND DISCUSSION

- The average ETc of pearl millet in the area is 527mm - this value is much higher than the average amount of seasonal rainfall recorded in all locations of the agricultural watershed which ranged from 50 to 379 mm for seasons 2015/2016 and 2016/2017.
- The daily rainfall vary significantly (p<0.05) within a distance of 0.5 km. The daily variability is by far higher than the monthly and seasonal variability.
- Farmers have adapted to these conditions by using crop management strategies such as dry-seeding, re-seeding, transplanting, varying sowing dates and spatially distributing their fields across larger areas. Still they have been repeatedly suffering from crop failures.
- Current use of tied ridges and microdose fertilisation has improved pearl millet yield from 0.312 to 1.318 kg/ha in Idifu.

CONCLUSION

- Rainfall varies significantly over a short distance.
- The variability causes yield gaps between farmers in the same agricultural watershed.
- Infield RWH systems reduce the risk of pearl millet crop failure due to spatio-temporal rainfall variability.
- Microdose fertilization are effective in reducing the risks of production associated with poor soil fertility.

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