Assessing Integrated Agricultural Systems for Developing Food Security

Julliyan S. Sone[1]✉; Gabriela C. Gesualdo[1]; Paula Prado[1]; Pedro Alberto P. Zamboni[1]; Rodrigo Bahia Pereira[1]; Glauber A. Carvalho[1]; and Paulo Tarso S. de Oliveira[1]

[1]Federal University of Mato Grosso do Sul, CxP. 549, Campo Grande, MS, 79070-900, Brazil. ✉ julliansone@gmail.com

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Background and Research Gaps

In 2018, FAO is focusing on climate variablity and extremes threatening to erode agricultural lands (FAO *et al.*, 2018)

- The probable decrease in rainfall erosivity over North and Northeast regions will likely contribute to the trend of agribusiness development in these areas (MATOPIBA) (Almagro *et al.*, 2017), so that understanding the impact of intensified agricultural production on soil and water loss erosion is key.
- Embrapa Gado de Corte has been developing a long-term experiment in which crop-livestock integrated systems are studied since 1993. It is focused on comparing agronomic to economic efficiencies and assess the production sustainability under different management systems (Macedo, 2009).

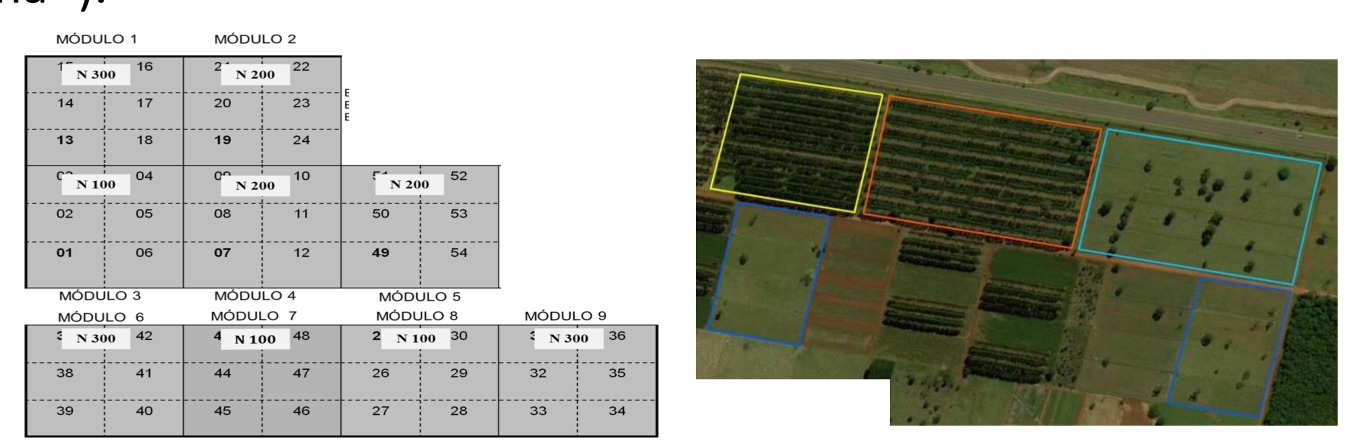
Objective

We assessed whether integrated agriculture-crop-livestock production reduces erosion impacts on food production improving security

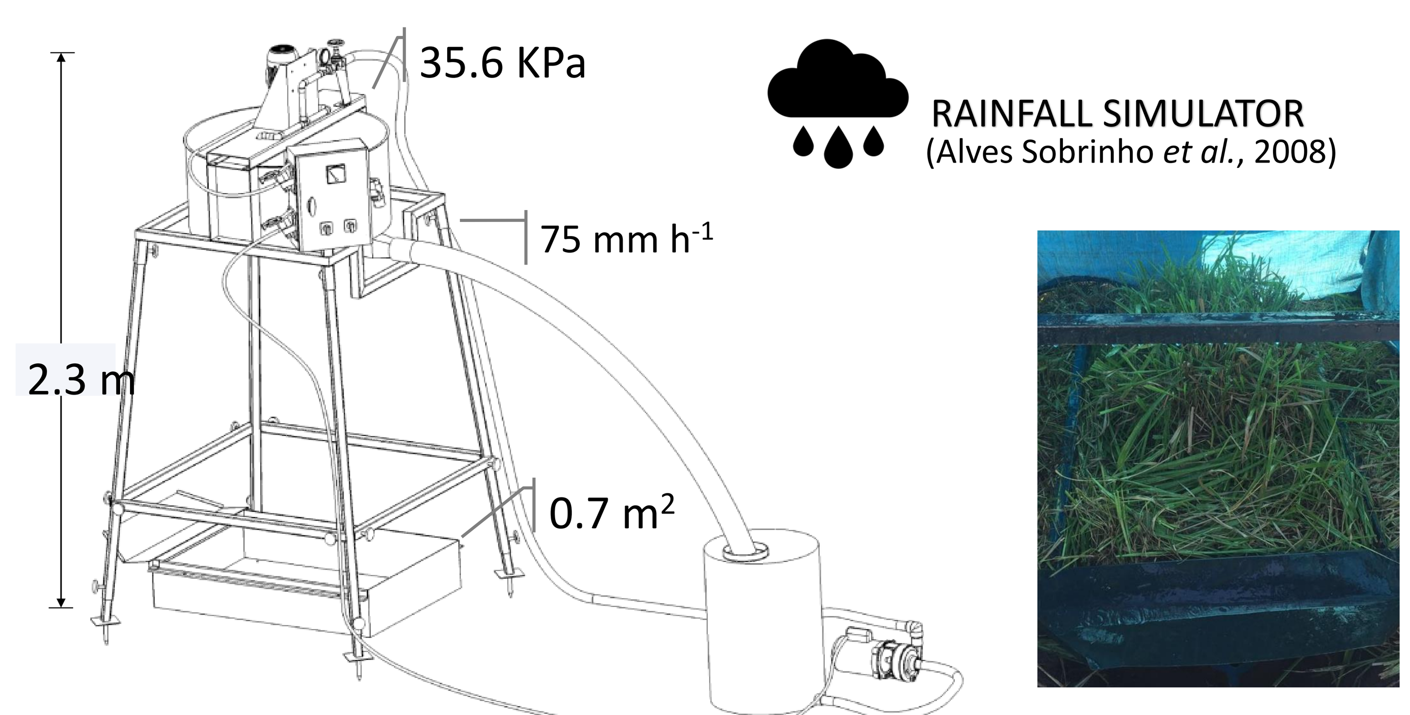
Materials and Method

The area is characterised as tropical wet-dry climate zone with an altitude of 530 m. The soil order that occurs is Dystrophic Red Latossols, clayey texture (30-41% at 0-20 cm depth). It is the main soil order in Brazil, covering about 32% of the territory mainly in the Brazilian Cerrado. Red Latossols have high agricultural potential due to physical and chemical soil conditions.

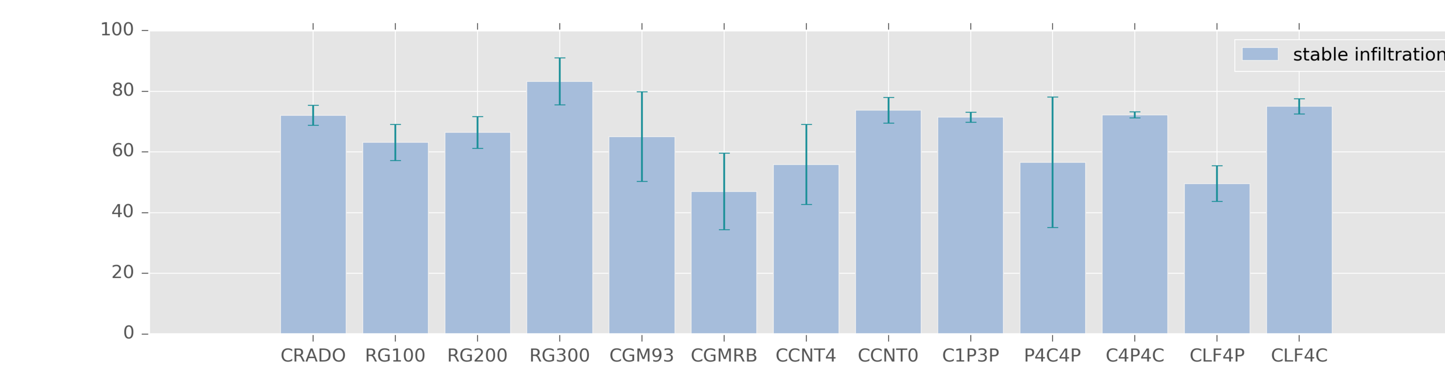
- *Panicum maximum* cv. Mombaça pasture under Rotational Grazing and variable stocking rate (RG100, RG200 e RG300 Kg N ha^{-1}).

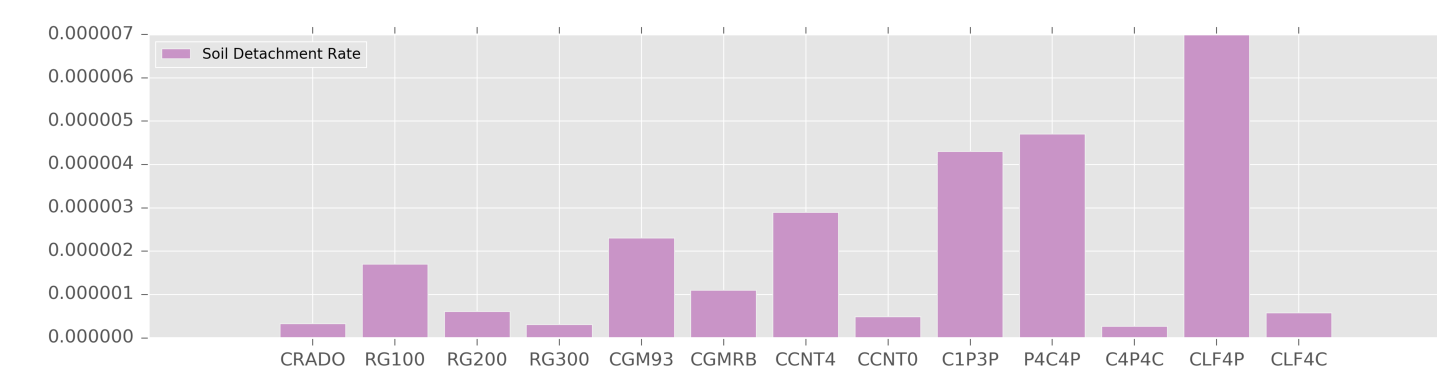


- *Brachiaria decumbens* pasture under Conventional Grazing and variable stocking rate. CGM93 treatment consists of a single fertilization in 1993, and CGMRB consists of periodical fertilization depending on soil physical and chemical analysis.
- Continous cropping under no-tillage and subsoiling every four years (CCNT4); and continuous cropping under no-tillage and no subsoiling (CCNT0).
- C1P3M treatment consists of one-year soybean cropping is followed by three-year *Brachiaria Brizantha* cv. Piatã pasture. P4C4P and C4P4C treatments have the same soil management and conservation system while one has produced soybean under no-till for 4 years, the other has produced Panicum Maximum cv. Massai pasture under continuous grazing and variable stocking.
- The agrosylvopastoral system consists of cropping, livestock and forest integrated production in which Eucalyptus *urograndis* is associated with four-year soybean cropping followed by four-year *Panicum Maximum* cv. Massai pasture.



Results





Conclusions

- Our findings show that intensive agriculture under conservation management increase water infiltration (RG300>RG200>RG100) and decrease soil loss (RG300<RG200<RG100).
- Crop cultivation under no-til and no-subsoiling presented higher water infiltration rate and fewer soil loss, compared to cultivation under no-till and subsoiling every 4 years.
- The integrated agroforestry system decreased soil and water losses at the stage of pasture to crop change. On the other hand, crop to pasture change presented higher soil loss and fewer water infiltration rates. It shows the relevance of vegetation cover in protecting soil from water erosion.

References

Almagro, A., Oliveira, P.T.S., Nearing, M.A., Hagemann, S., 2017. Projected climate change impacts in rainfall erosivity over Brazil. Sci. Rep. 7, 8130. https://doi.org/10.1038/s41598-017-08298-y

Alves Sobrinho, T., Gómez-Macpherson, H., Gómez, J.A., 2008. A portable integrated rainfall and overland flow simulator. Soil Use Manag. 24, 163–170. https://doi.org/10.1111/j.1475-2743.2008.00150.x

FAO, IFAD, UNICEF, WFP, WHO, 2018. Building climate resilience for food security and nutrition. FAO, Rome.

Macedo, M.C.M., 2009. Integração lavoura e pecuária: O estado da arte e inovações tecnológicas. Rev. Bras. Zootec. 38, 133–146. https://doi.org/10.1590/S1516-35982009001300015

United Nations, 2017. World Population Prospects: The 2017 Revision. New York.

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