Energy Transition
RESEARCH & INNOVATION

SÃO PAULO, BRAZIL | NOVEMBER 7-9, 2023

Energy Transition Research & Innovation Conference

ETRI 2023

BOOK OF ABSTRACTS

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We gratefully acknowledge the support of the RCGI – Research Centre for Greenhouse Gas Innovation (23.1.8493.1.9), hosted by the University of São Paulo (USP) and sponsored by FAPESP – São Paulo Research Foundation (2020/15230-5) and Shell Brasil, as well as the strategic importance of the support given by ANP (Brazil's National Oil, Natural Gas and Biofuels Agency) through the R&DI levy regulation.

DOI: 10.5281/zenodo.12744754

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DOI: 10.5281/zenodo.12744754

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Abstract Title: Integrated crop-livestock systems and well-managed pasture promote biological activity, aggregates stability and the increase of soil organic carbon in southern Amazon, Brazil

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Abstract: Integration crop-livestock (ICL) systems are known to have higher diversity of roots and crop residues that favor microbial activity and increase the potential of soil carbon (C) sequestration. This study aimed to investigate the impact of different integrated agricultural systems on microbial indicators, total C content and aggregation over eleven-year period. A field experiment was conducted in a randomized block design with four replications and four treatments: Crop succession (CS) - annual production of soybean (Glycine max L.) followed by corn (Zea mays); Integrated crop-livestock system (ICL) - a rotation system of four years with soybean/corn production in the first year, soybean/corn + braquiaria (Brachiaria brizantha cv. Marandu) in the second year, and followed by two years of pasture associated with cattle production; Pasture (P) – continuous cultivation of Brachiaria brizantha (cv. Marandu) with cattle production; and Integrated crop-livestock-forest system (ICLF) – similar to ICL system, with the eucalyptus as additional forest component. Soil samples were collected to a 0.3 m depth, in which the total C, total nitrogen (N) contents, microbial biomass carbon (MBC), glomalin, enzymatic activities of β glucosidase, acid phosphatase and arylsulfatase were measured. In addition, the soil structural quality was measured from the mean weight diameter (MWD) of aggregates. Our findings revealed that P and ICL increased C (28%) at 0.1 m and N content at 0.05 m depths, while MBC was higher (50%) in all layers evaluated as compared to CS, thus indicating that MBC is more sensitive to management change relative to C content. Similar results were found for enzyme activity, especially at 0.05 m layer for all enzymes.

Regression analyses proved that C accrual was triggered by the increase in enzyme activity, due to the role of C as energy source for the microbiota. We found lower C/N ratio under ICL, and higher microbial quotient (qmic) under ICL and P, suggesting a better C utilization by the microorganisms. MWD and glomalin increased under P, ICL and ICLF at 0.1 m, indicating higher soil aggregation in these systems. Our study suggests that ICL and P systems play an important role in C accumulation by favoring microbial activity and soil aggregation when compared to more conventional cropping systems.

Keywords: Soil organic matter; Soil carbon stabilization; Soil microbiology; Soil enzymes; Soil aggregation; Soil health.

Introduction and Objectives: Integration crop-livestock (ICL) systems are known to have higher diversity of roots and crop residues that favour microbial activity and increase the potential of soil carbon (C) sequestration. This study aimed to investigate the impact of different integrated agricultural systems on microbial indicators, total C content and aggregation over eleven-year period.

Methodology: A field experiment was conducted in a randomized block design with four replications and four treatments: Crop succession (CS) - annual production of soybean (Glycine max L.) followed by corn (Zea mays); Integrated crop-livestock system (ICL) - a rotation system of four years with soybean/corn production in the first year, soybean/corn + braquiaria (Brachiaria brizantha cv. Marandu) in the second year, and followed by two years of pasture associated with cattle production; Pasture (P) – continuous cultivation of Brachiaria brizantha (cv. Marandu) with cattle production; and Integrated crop-livestock forest system (ICLF) – similar to ICL system, with the eucalyptus as additional forest component. Soil samples were collected to a 0.3 m depth, in which the total C, total nitrogen (N) contents, microbial biomass carbon (MBC), glomalin, enzymatic activities of β-glucosidase, acid phosphatase and arylsulfatase were measured. In addition, the soil structural quality was measured from the mean weight diameter (MWD) of aggregates.

Preliminary results: Our findings revealed that P and ICL increased C (28%) at 0.1 m and N content at 0.05 m depths, while MBC was higher (50%) in all layers evaluated as compared to CS, thus indicating that MBC is more sensitive to management change relative to C content. Similar results were found for enzyme activity, especially at 0.05 m layer for all enzymes. Regression analyses proved that C accrual was triggered by the increase in enzyme activity, due to the role of C as energy source for the microbiota. We found lower C/N ratio under ICL, and higher microbial quotient (qmic) under ICL and P, suggesting a better C utilization by the microorganisms. MWD and glomalin increased under P, ICL and ICLF at 0.1 m, indicating higher soil aggregation in these systems.

Preliminary conclusions: Our study suggests that ICL and P systems play an important role in C accumulation by favouring microbial activity and soil aggregation when compared to more

conventional cropping systems.

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Abstract Title: Deforestation Patterns Evolution of the Amazon Basin from 1985 to 2021

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Abstract: This study explores deforestation indicators in the Brazilian Amazon rainforest. Employing image processing techniques, we identified deforested patches over 37 years, spanning 3 million km2. Geometric measures assessed patch regularity and area, revealing clear trends: compactness followed a lognormal distribution, while equivalent radii decreased logarithmically. Cluster analysis was applied to group regions
with similar deforestation patches. The results were consistent with the east-to-west deforestation shift and each cluster displayed unique compactness and equivalent radii. The increase in the compactness time series indicates more organized
patches consistent with human-made deforesting. Equivalent radii distribution revealed patch enlargement within 1-2 km. These observed trends in compactness and
equivalent radii can be used in models studying the links between land use and climate change. They can also enhance understanding of Amazon deforestation, guiding evidence-based policies for its conservation.

Keywords: Land Use; Amazon Rainforest; Landscape Ecology; Fragmentation.

Introduction and Objectives: This study aims to analyse and describe deforestation patterns in the Amazon rainforest and how they have evolved. The land use patterns were classified based on their shape, size, and rate of deforestation, dividing the Amazon rainforest into four distinct regions, each with its unique characteristics. Unlike previous works on deforestation in the Amazon rainforest, which only studied small areas or limited periods (his study covers 36 years and an area of approximately
3 × 10^6 sqkm within the Brazilian Amazon.

Methodology: We used land use and land cover (LULC) maps from the MapBiomas platform. First we separated natural formations from those altered by human interference (e.g. pastures, cultures, mining etc). The images were processed and segmented, and each deforestation patch